UNIVERSITY OF KWAZULU-NATAL

INYUVESI YAKWAZULU-NATALI

UNIVERSITY OF KWAZULU-NATAL

COLLEGE OF HEALTH SCIENCES

Knowledge, Attitudes and Practices of Exit-Level Health Sciences Students at a Selected University in Durban, South Africa, towards the Consumption of Sugar-containing Beverages Following the Introduction of the Sugar Tax in South Africa

Lavern Samuels

UNIVERSITY OF KWAZULU-NATAL

COLLEGE OF HEALTH SCIENCES

SCHOOL OF HEALTH SCIENCES

DISCIPLINE OF DENTISTRY

Knowledge, Attitudes and Practices of Exit-Level Health Sciences Students at a Selected University in Durban, South Africa, towards the Consumption of Sugar-containing Beverages Following the Introduction of the Sugar Tax in South Africa

A Thesis submitted as part of the requirement for the degree

Master of Medical Science

Student : Lavern Samuels

Student Number : 8421312

Supervisor : Dr Tufayl Ahmed Muslim

Date Submitted : February 2021

ABSTRACT

Introduction

South Africa has the highest prevalence of lifestyle-related diseases, such as diabetes, dental caries, and obesity-related diseases. Many of these diseases are expensive and difficult to treat and place a burden on the healthcare system. If sugar-consumption can be decreased, then the prevalence of these diseases can be reduced, resulting in financial savings and reduced disease burden. Consequently, there will be a reduction in the number of healthcare workers needed, and the costs of delivering healthcare to the population.

The sugar tax was implemented in South Africa to directly raise revenue for the State that could be utilised to prevent and treat lifestyle-related diseases and indirectly increase the price of food products containing sugar to reduce sugar consumption. It was envisaged that this reduced sugar consumption would reduce obesity and in diseases that have sugar as a causative agent. Healthcare professionals can play a critical role in advising patients on reducing sugar intake, especially with reduced consumption of sugar-sweetened beverages.

Aim and objectives

This study aimed to determine the knowledge, attitudes and practices of knowledge, attitudes and practices of exit-level health sciences students at a selected University in Durban, South Africa, towards consuming sugar-containing beverages following the introduction of a sugar tax.

Methods

Gatekeeper permission was obtained from the Durban University of Technology and final ethical approval from the University of KwaZulu-Natal. Online information sheets about the study were made available to 150 final-year students in the health sciences professions and informed consent was obtained. An online questionnaire was administered to the participants. It included questions around participants sociodemographic profile, knowledge of the sugar tax and SSBs, attitudes towards the sugar tax and SSBs, and perceptions of their practices relating to dietary advice and the sugar tax. Qualitative data were analysed using NVivo, and quantitative data using the Statistical Package for the Social Sciences (SPSS) (version 25) SPSS.

Results

The study population consisted of a young population with the mean age being 23.6 years. Most participants (60.4%, n=40, *p*.101707 – not significant), left the purchasing and food-choice decisions to their parents. Most participants (n=39, 59%) reported that they had changed their SSBs consumption habits. Most (78.2%, n=51) participants were not aware of the sugar tax's purpose and its introduction.

Participants were mostly positive 61% (n=40) on their attitudes towards the merit of the implementation of a sugar tax, but 21 participants (32%) had a negative view of this tax, citing reasons such as that "even with an increase of the sugar beverages price, consumption will not decline." The sugar tax theme is an excessive burden placed on an already over-taxed society. A violation of personal and constitutional rights was reported by 27% (n=18) of the participants who supported the sugar industries anti-sugar tax stance.

Only 24% (n=16) believed they had not received sufficient education and training around sugar consumption containing beverages. Participants reported having had minimal training, lacking in-depth knowledge of the current literature about SSBs consumption.

Conclusion

This study raises several important questions regarding nutritional training among the various cadres of health sciences students at universities and technology universities. According to the results, it appears that there is a need for curriculum reform that would lead to improved training in diet and nutrition advice content. This is so that future health professionals will be more aware of the current trends and practices about diet and nutrition, thus offering their clients/patients holistic health management and treatment course of care. Extensive curriculum reform and redesign should occur, in that extensive training and education be given to all Health Sciences students and future healthcare workers about the ill effects of excessive sugar consumption, and that they are trained in being able to render dietary counselling and advice to their prospective patients

Keywords: sugar tax, healthcare professionals, sugar-sweetened beverages

Preface and Declaration

Preface

The study "Knowledge, Attitudes and Practices of Exit-Level Health Sciences Students at a Selected University in Durban, South Africa, towards the Consumption of Sugar-containing Beverages Following the Introduction of the Sugar Tax in South Africa" was conducted to understand the KAPs of these students, and future healthcare professionals, as well as to understand their intended roles as diet and nutrition advisers during their holistic management of patients under their care."

Declaration by Candidate

I, Lavern Samuels, declares that:

i. The research reported in this thesis, except where otherwise indicated, and is my original work.

ii. This thesis has not been submitted for any degree or examination at any other university.

iii. This thesis does not contain other persons' data, pictures, graphs or additional information unless acknowledged explicitly as sourced from other persons.

iv. This thesis does not contain other persons' writing unless expressly acknowledged as being sourced from other researchers. Where other written sources have been quoted, then:
   a) Their words have been re-written, but the general information attributed to them has been referenced;

   b) Their exact words have been used, their writing has been placed inside quotation marks, and referenced.

v. Where I have reproduced a publication of which I am author, co-author or editor, I have indicated in detail which part of the publication was actually written by myself and have fully referenced such publications.

vi. This thesis does not contain text, graphics or tables copied and pasted from the internet, unless expressly acknowledged. The source is detailed in the Thesis and the References sections.

NAME: Lavern Samuels SIGNATURE: L Samuels

STUDENT NUMBER: 218082844 DATE: 15 February 2021

Declaration by Supervisor

This is a thesis submitted to the Discipline of Dentistry, School of Health Sciences, University of KwaZulu-Natal, for the Master of Medical Science degree.

This thesis, in which the chapters are written as a research publication, has followed the School of Health Sciences thesis by manuscript/publication format. The presentation comprises three chapters which include Chapter 1 (Introduction, Literature Review, Methodology), Chapter 2 (Journal Article Presentation), and Chapter 3 (Conclusion and Recommendations).

This is to certify that the contents of this thesis is the original research work of Dr Lavern Samuels, carried out under the supervision of Dr TA Muslim, at the Discipline of Dentistry, School of Health Sciences, Westville Campus, University of KwaZulu-Natal, Durban, South Africa (SA).

Supervisor: Dr TA Muslim

Signed: 

Date: 15 February 2021

Declaration of Prior Publication

I, Lavern Samuels, hereby declare that this Thesis has not been submitted for a degree at any other university.

NAME: Lavern Samuels

SIGNATURE : L Samuels

DATE: 15 February 2021

SUPERVISOR: Dr TA Muslim

SIGNATURE : 

DATE: 15 February 2021

Contribution of Authors and Co-Authors

I, Lavern Samuels, hereby declare that contributions of the authors to any conference posters, conference papers, manuscripts and journal publications that may arise out of this study are as listed below:

Author: Lavern Samuels
Contributions: Conceived and implemented the study design. Collected and analysed data. Wrote first and final drafts of the manuscripts. Made the major contribution in the formulation of the paper.

Co-Author: Tufayl Ahmed Muslim
Contributions: Assisted in the contextualisation of the paper. Helped conceive the study design. Provided field expertise, feedback on statistical analysis and early drafts of the manuscript. Provided comments on the manuscript/journal article.

Lavern Samuels	Tufayl Ahmed Muslim
NAME	SUPERVISOR
L Samuels	
SIGNATURE	SIGNATURE
DATE: 15 February 2021	DATE: 15 February 2021

Acknowledgements

I would like to express my sincere thanks to the following people and institutions for their help during this project:

1. To my parents Cedric and Jaya Samuels, my external gratitude for their unflinching love, constant support, inspiration and for always believing in me.

2. To my sister Samantha Samuels and my niece Darshmika Reddy for their encouragement, motivation, and love.

3. To my mentor and friend Professor Tandi Gwele for being an outstanding role model in so many ways.

4. To the students and colleagues at DUT who participated in the study goes my appreciation.

5. To my supervisor, Dr Ahmed Muslim goes my deep appreciation for unfailing commitment, collegiality, and care - always going the extra mile as a supervisor.

.

Manuscript Prepared for Publication

Knowledge, Attitudes and Practices of Exit-Level Health Sciences Students at a Selected University in Durban, South Africa, towards the Consumption of Sugar-containing Beverages Following the Introduction of the Sugar Tax in South Africa

Lavern Samuels[1], Tufayl Ahmed Muslim[2]

Lavern Samuels: Conceived and contributed to the project's design, performed the data collection and analysis and wrote the paper. Made a significant contribution in the formulation of the paper.

Tufayl Ahmed Muslim: Assisted in the contextualisation of the paper and provided comments on the paper.

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION, LITERATURE REVIEW AND METHODOLOGY

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ABA - American Beverage Association

ABC - Australian Beverages Council

BREC - Biomedical Research and Ethics Committee

NIDDM - Non-Insulin Dependent Diabetes Mellitus

NCDs - non-communicable diseases

NHI - National Health Insurance Scheme

PHC - Primary Health Care System

SASA - South African Sugar Association

SSBs - Sugar-Sweetened Beverages

WHO – World Health Organisation

LIST OF DEFINITIONS

Sugar-Sweetened Beverages - beverages that contain added caloric sweeteners such as sucrose, high-fructose corn syrup (HFCS), or fruit- juice concentrates, which include but are not limited to:

(i) soft drinks,
(ii) fruit drinks,
(iii) sports and energy drinks,
(iv) vitamin water drinks,
(v) sweetened iced tea, and
(vi) lemonade, amongst others.

CHAPTER 1: INTRODUCTION, LITERATURE REVIEW AND METHODOLOGY

1.1 Introduction

This chapter introduces the study, outlines the problem statement, and provides background and context to the research and a rationale for the study. The study's research question is then presented, and after that, the aim and objectives of the study outlined. An extensive review of the literature is then presented. The chapter concludes with a detailed presentation of the research methodology used in this study.

1.2 Background

South Africa has the highest prevalence of lifestyle-related diseases, such as diabetes, dental caries, and obesity-related diseases. Many of these diseases are expensive and difficult to treat and place a burden on the healthcare system. If sugar-consumption can be decreased, then the prevalence of these diseases can be reduced, resulting in financial savings and reduced disease burden. Consequently, there will be a reduction in the number of healthcare workers needed, and the costs of delivering healthcare to the population.

The sugar tax was implemented in South Africa to directly raise revenue for the fiscus that could be used to prevent and treat lifestyle-related diseases and indirectly increase the price of food products containing sugar. This was to reduce sugar consumption, hoping that this reduced sugar consumption will lead to a reduction in obesity and in diseases that have sugar as a causative agent.

Healthcare professionals can play a critical role in advising patients on reducing sugar intake, especially with reduced consumption of sugar-sweetened beverages.

The worldwide increase in diet-related diseases has prompted strong and insistent calls from public health organisations and advocacy bodies to implement larger, multi-sectoral health promotion and prevention efforts and strategies to combat these increases in prevalence rates (Le Bodoa, Etiléc, Gagnon and De Wals, 2019; World Health Organisation, WHO, 2014). Different governments have put various interventions around the world to address these public health concerns.

The South African government has, in the recent past, introduced various policy initiatives that are aimed at health and environment protection and improvement. Whilst some of these initiatives are aimed at environmental protection, others have a focussed approach on oral and general health. A few of these initiatives include:

- The Carbon Tax Bill which was passed in 2018, and the tax implemented in 2019, and had as its aim the need to reduce littering and increase plastic bag reuse and recycling the levy on plastic bags has been increased by 50% to 12 cents per bag as of 01 April 2018. In the 2020 budget speech, this tax was raised by a further 13 cents a bag. The environmental levy on incandescent light bulbs has also increased from R6 to R8 to encourage consumers to switch toward using energy-efficient light bulbs (National Dept. of Health, 2013).
- Vehicle emission taxes, which are targeted at certain vehicles that emit emissions above a certain level, are also being increased.
- Whilst not yet being implemented, the State is considering introducing an acid mine drainage levy, which would target polluters to pay for the cost of environmental damage (National Dept. of Health, 2013).

A tax that would have significant ramifications for oral health, in particular, is the so-called sugar tax, which in 2014 was levied at a rate of 11%. Officially called the "Health Promotion Levy", this tax has resulted in South Africans paying more for sugary drinks from 01 April 2018. These regulations are contained in Government Gazette No. 41323 of 14 December 2017. It amounts to a tax of 2.1c per gram of sugar per 100ml, above 4 grams per 100ml. This new tax has contributed R1.9bn in additional revenue, according to the budget. Still, it is significantly less than some initial estimates, which argued that the tax could bring in as much as R10bn (Manyema, Veerman, Chola, Tugendhaft, Sartorius, Labadarious and Hofman, 2014; National Dept. of Health, 2013).

The term "sugar" as used in the concept of the sugar tax, is a misnomer as the tax is not levied on solid sugar or sugary substances but rather on sugar-sweetened beverages (SSBs) (Fung, Malik, Rexrode, Manson, Willet, and Hu, 2009). These beverages contain added-caloric sweeteners such as sucrose, high-fructose corn syrup, or fruit juice concentrates. The health promotion levy aims to fund health promotion activities that would reduce obesity rates and improve population health outcomes (National Dept. of Health, 2013). This is essential when one notes that there has been a reduction in the number of tobacco users and the incidence of tobacco-related diseases since the introduction of raised tobacco taxes and anti-smoking policies. It is envisaged that the sugar tax could have similar implications on oral and general health standards (Backholer and Martin, 2017).

South Africa has the dubious reputation of being one of the top three countries in obesity rates. The alarming sugar consumption rates put South Africa amongst the top 10 soft-drink consumers globally (National Dept. of Health, 2013). Scientific evidence has demonstrated the association between sugar consumption and certain chronic diseases (National Dept. of Health, 2013). Whilst acknowledging that many non-dietary factors play a role in chronic diseases, obesity is one of the five risk factors for early death. With 43% of South Africa deaths being attributed to obesity-related chronic diseases (such as heart disease, stroke and some cancers) (National Dept. of Health, 2013).

It is envisaged that the implementation of the sugar tax will lead to a reduction in soft-drinks consumption, with the associated decrease in the rate of caries and improved oral and general population health status (Manyema et al., 2014). In 2014 the sugar tax policy (at a rate of 10%) was introduced in Mexico, and a 6% decline in sugary drink purchases was evident in the first year (Backholer and Martin, 2017).

1.3 Description of Research Problem, Problem Statement and Significance of Research

South Africans access various healthcare services such as medical, dental and paramedical services. These services are often accessed at gateway clinics, or through different primary healthcare system (PHC) facilities. The focus of healthcare has moved from curative to a PHC philosophical approach to prevention. As such, students in health sciences must provide curative and rehabilitative services and provide preventive advice such as health care education and nutritional and dietary advice to the patients (clients) that they serve. The personal knowledge, attitudes and perceptions (KAPS) of these future healthcare providers could influence the dietary and nutritional advice that they provide to patients under their care. Therefore, it is essential to assess these KAPs so that appropriate measures could be put into place at both a macro-policy and curriculum level to ensure that students in the health sciences are enabled to offer relevant and evidence-based dietary and nutritional advice.

1.4 Research Question

Are the education and training and healthcare provision practices of a cohort of future healthcare practitioners conducive to them rendering dietary and nutritional advice to the patients and communities they would interact with as they enter the working world upon qualification?

1.5 Purpose of the study

The rationale of this study is to understand the education and training and practices of a cohort of future healthcare practitioners. This will identify any weaknesses so that interventions and policies could be constructed to encourage prospective healthcare providers to address obesity and high sugar intake in the form of SSBs consumption reduction. These interventions could include curriculum reform as well as the scope of practice reviews.

1.6 Chapter Outline

The current study is presented in the following sections, as illustrated below. This section of this research study provides a comprehensive summary of aspects of the implementation, effects (positive and negative), global challenges, and dynamics influencing introducing a sugar-tax imposed on SSBs in South Africa. The existing deficits which need to be addressed are clearly outlined in the problem statement section. The purpose and research question of the study which needs to be answered is also described. Finally, the study's aim and objectives and the different steps involved in achieving them are expounded. After that, a review of the research methodology used in this study is presented.

1.7 Literature Review

1.7.1 Introduction

This section provides an overview of the literature about the sugar tax implementation internationally and in South Africa. The literature search was accomplished using the search terms: “sugar tax”, “sugar-sweetened beverages,” dietary advice” and “health practitioners dietary advice patterns”. A complete and thorough search was conducted using various search engines and tools such as Google Scholar, PUBMED, Research Gate, Wiley Online and Science Direct. This extensive search was conducted to gain a comprehensive background and understanding of the research theme. The search results are presented and reviewed in the literature review that follows.

1.7.2 Background and Rationale for Targeting Sugar-Sweetened Beverages

SSBs are beverages which have substantial amounts of sugar added to them during the manufacturing process. SSBs provide a high dose of sugar that does not contain any nutritional benefits to the consumer. A decrease in the consumption of SSBs has the potential to reduce

both sugar and calorie intake. Therefore, programmes aimed at this type of sugar reduction are ideal for public health action (Allen and Allen, 2020). The consumption of excessive sugar has damaging effects on society, and in 2015 a study by Harvard University researchers estimated that there were more than 180,000 deaths annually that could be attributed to SSBs consumption (Pan and Hu, 2011). The taxation on SSBs is also part of a public health policy that, besides generating revenue for the fiscus allocated to purchasing healthcare, also reduces the burden on other taxpayers. The World Health Organisation (WHO), in 2016, published global data that showed that young people have a disproportionately high intake of SSBs consumption and that they consume these beverages on an almost daily basis. The World Health Organisation quotes the example of Argentina, wherein in 2012, it was reported that 66.1% of school-aged children consumed SSBs daily. In the 2011-2012 Australian Health Survey it was revealed that around 1/3rd of the population consumed SSBs daily, with the highest consumption rates being registered amongst teenagers in the age group 14 to 18 years (Ventura and Menella, 2011). Consequently, the World Health Organisation recommended in 2016 that some of the measures that could be used in countries policies for preventing non-communicable diseases could include raising the retail prices of SSBs by 20% or more (Backholer, Blake and Vandevijvere, 2016).

The United Nations, (United Nations, 2011) and other leading-opinion makers such as the World Health Organisation (WHO, 2004; WHO, 2014) recommended the taxation of Sugar-Sweetened Beverages (SSBs) as one of the tools that could be used. This was despite this recommendation being controversial and meeting with massive resistance from the sugar and beverage industry. However, Le Bodoa et al., (2019), and Yang, Bovet, Liu (2017), argue that there is a wealth of scientific and anecdotal evidence to highlight the benefits of a tax on SSBs on obesity-related diseases would have. Studies over the years in various states and countries, such as in Mexico (Popkin (2017), and in California by Silver, Ng, Ryan-Ibarra, Taillie, Induni, Miles, Poti and Popkin (2017) and have provided evidence that the introduction of a substantial sugar tax has on decreasing sugar intake.

1.7.3 International Implementation of the Sugar Tax

Numerous countries and states within countries have implemented a sugar tax or other regulatory measures to curb sugar-sweetened beverages (SSB). These initiatives resulted from pressing calls from public-health advocates and the World Health Organisation (WHO, 2004, WHO, 2014). These countries and cities/states include Australia, Brunei, Portugal, Saudi

Arabia, United Arab Emirates, Thailand, the Philippines, the Catalan region of Spain, six US cities; the UK, the Republic of Ireland, Peru, Norway, South Africa, and Estonia (Backholer, Vandevijvere, Blake, Tseng, 2019; Backholer and Martin, 2017). The following table outlines which countries have implemented the sugar tax and the implementation dates.

Table 1.1 Current international sugar tax initiatives

Country/State/Region	Date of Introduction	Country/State/Region	Date of Introduction
Hungary	September 2011	French Polynesia	2002
France	January 2012	Mauritius	2013
Mexico	October 2013	Samoa	1984
Chile	October 2014	St Helena	March 2014
United Arab Emirates	October 2017	Nauru	2007
Norway	January 2018	California	January 2015
South Africa	April 2018	Pennsylvania	June 2016
Ireland	April 2018	San Francisco	January 2018
UK	April 2018	Oakland	July 2017
Philippines	December 2018	Albany	April 2017
Barbados	September 2015	Colorado	2017
Fiji	2006	Washington	January 2019

Source: Allen and Allen, 2019, Should Australia tax sugar-sweetened beverages? *Journal of Paediatrics and Child Health*, **56:** 8–15.

1.7.4 Benefits of a Sugar Tax

Backholer and Martin (2017) argue that there are several intended benefits of an SSB tax, and enumerate them as being the following four: (i) an increase in the retail price of SSB would is envisaged to lead to a reduction in the consumption of SSB and produce public health benefits; (ii) generation of substantial revenue, which could be reinvested back into public health improvements and initiatives; (iii) communication of a powerful message to the general public that regular consumption of SSB is not part of a healthy diet; and (iv) incentive for manufacturers and producers to reformulate to lower-sugar products (as the tax is linked to the amount of sugar contained in the beverage). Other authors provide evidence from studies that they have conducted to confirm that SSB taxation encourages the consumption of healthier beverage options such as water or sugar-free drinks (Redondo, Hernández-Aguado, Lumbreras, 2018; Roberts, Ells, McGowan, Machaira, Targett, Allen, Tedstone, 2017; Wright, Smith,

Howell, 2017). Overall, taxing SSB is recommended by the WHO (2015) and others as it remains potentially amongst the most cost-effective nutritional and health-promoting policies due to its high population reach, low implementation cost, and is a significant tax generator for the fiscus (Thow, Downs, Mayes, Trevena, Waqanivalu and Cawley, 2018; Gortmaker, Swinburn, Levy, Carter, Mabry, Finegood, Huang, Marsh, Moodie, 2011).

Creedy (2019), suggests that implementing a 20% tax on SSBs in New Zealand would reduce consumption of these beverages by 50%. Allen and Allen (2020) report on the effectiveness of the sugar tax in terms of a reduction in SSB consumption as follows: in France, soft drink sales decreased by 3% following a 5% increase in prices soon after the introduction of the tax; in Hungary, there was a similar decrease in the consumption of products affected by the sugar tax; Mexico experienced a 6% reduction in SSBs consumption, with the most significant decline being among households of low socioeconomic status; and in Chile, consumption was reduced by 21.6% in the year following the tax implementation of the tax.

1.7.5 The Beverage Industries Response to the Sugar Taxes

The South African beverage industry has already reacted to the tax in several ways (Backhoiler and Martin, 2017). These include the reduction of the sugar content of popular beverages using non-nutritive sweeteners, reformulating the ingredients and contents of certain beverages, promoting "diet" and "zero-content" beverages, and introducing smaller bottle sizes to curb excessive sugar consumption and limit the excise tax burden (Centre for Science in the Public Interest, 2016).

Many stores have also reacted to the sugar tax by promoting these reduced-sugar beverages. Some, such as Nandos Restaurants, even display differentiated beverage prices (sugar versus sugar-free) and have meal promotions that are lower priced when a low-sugar/sugar-free beverage is included in the advertisement. However, it must be noted that the tax is not just levied on cold-drinks, but also on soft drinks (including flavoured water), diluted fruit- and vegetable juices, flavoured milk (milkshakes), cocoa and other powders, as well as syrups and other, concentrates that are used in the manufacture of sweet beverages (Government Gazette No. 41323 of 14 December 2017).

The R14 billion South African sugar industry is cost-competitive, consistently ranking in the top 15 out of approximately 120 sugar-producing countries worldwide (SASA, 2019). Internationally, despite the political will to introduce a sugar tax being vociferous, there is stiff

opposition presented by the beverage industry (Backholer and Martin, 2017). This is understandable considering that sugarcane's global production outweighs that of any other crop (McKay, Sauer, Richardson and Herre, 2016).

The American Beverage Association spent more than US$ 2 million in the city of Berkeley, California and more than US$ 9 million in Philadelphia, Pennsylvania opposing an SSB tax. The Australian Beverages Council, the peak lobby group for sugary drink companies, has targeted key politicians and political parties to 'keep a tax off the policy table' (Australian Beverages Council (ABC) 2017, Centre for Science in the Public Interest, 2016). In Mexico, where the sugar tax was proposed in 2013, there were aggressive industry-funded media campaigns against the tax's introduction, and so too was their opposition in the United States (Myers, Fig, Tugendhaft, Mandle, Myers and Hofman, 2017). In South Africa the sugar industry also embarked on a media campaign, using slogans such as "sugar is not the new tobacco" and "myths about sugar" (including sugar gives you diabetes/sugar rots your teeth etc.) (Myers et al., 2017).

1.7.6 Policy-Makers Response to the Sugar Tax and High Levels of Sugar Consumption

There have been numerous and varied responses by policymakers worldwide to combat the adverse effects of obesity on populations. The adoption of these measures and policies have become a necessity, given the fact that 60% of daily energy intake is from carbohydrates such as refined cereals and sugars. Therefore, there is the emphasized importance of reducing sugar intake, especially free sugar intake (Megally and Al-Jawaldeh, 2020).

In the United States (U.S.), the National Center for Health Statistics (2017) reported that 38% of adults have obesity and that the rate amongst children and adolescents is 17%. Being overweight is a profound health burden and risk because of the numerous comorbidities linked to it. In a meta-analysis study, it was found that there were 18 comorbidities associated with overweight and obesity, including type 2 diabetes, asthma, chronic back pain, osteoarthritis, gallbladder disease, cardiovascular diseases (CVD), and certain cancers conducted (Guh, Zhang, Bansback, Amarsi, Birmingham and Anis, 2009). With the high prevalence of obesity among sports children and adults in numerous countries globally, and what high prevalence of diabetes rates internationally. Allen and Allen (2020), postulate that in Australia there has been an increase in the number of conditions associated with westernized diets and lifestyles, including conditions such as type 2 diabetes (Non-insulin-dependent diabetes mellitus

(NIDDM)), and obesity (body mass index greater than or equal to 30 kg/m2). There is ample evidence to show that these conditions are interrelated with the causative factor being an unhealthy diet rich in refined sugars (Allen and Allen, 2020).

The need to reduce the consumption of sugar is of paramount importance. Saudi Arabia, part of the Gulf Cooperation Council (GCC), has a high prevalence of obesity (13.4%) and overweight (18.2%) (WHO, 2016). In Australia Allen and Allen (2020) report that between 1995 and 2015 there was an increase in obesity rates from 19% to 28% while the incidence of NIDDM rose from 3.8% in 2011 to 4.4%. In 2014 Allen and Allen (2020) also provided evidence to show that obesity rates amongst children aged between 2-9 years were 20%, and amongst children aged 10 to 17 years they found that 30% of these children were overweight.

Despite strong evidence, there was much resistance to introducing the sugar tax in states, regions and countries where this tax was implemented. Some countries and regions have even repealed their tax with Finland and Denmark, both doing so amidst claims that it was ineffective and stifling business opportunities (Allen and Allen, 2020). In some countries where a sugar tax has been proposed, policymakers have been confronted by industry advocacy groups who conducted aggressive political campaigns to block the policy. In 2016 the sugar tax implementation plan was halted following opposition from politicians, and Denmark was also forced to abandon the sugar tax introduction based on industry lobbying and political pressure (Strom, 2018).

1.7.7 Positive Effects of the Sugar Tax

Public Health England has reported that the sugar content across all beverages subjected to the UK tax had been reduced by 11% between 2015 and 2017. The average energy consumed in a single occasion fell by 6% since the sugar tax introduction in 2016 (Public Health England, 2018).

In 2013 it was reported that 13.5% of men and 42% of women over the age of 20 years had a Body Mass Index (BMI) greater than 30kg/m^2. This data made South Africa the third most obese nation on the African continent (Myers et al., 2017). In South Africa, the National Department of Health in 2013 reported that NCDs account for 40% of all deaths. Of the 6-year-olds, 60% have tooth decay, 98% of 44-year-olds have gum disease, and South Africa ranks

number eight worldwide for sugar consumption (Myers et al., 2017). According to the South African Sugar Association (SASA), the average South African consumed 36.4kg of sugar in 2012-2013 (SASA, 2013; SASA 2019).

1.7.8 Negative Effects of High Levels of Sugar Consumption

Excessive sugar consumption is an international public health concern (Megally and Al-Jawaldeh, 2020; Myers et al., 2017). It is a well-established fact that sugar-sweetened beverage consumption is related to several adverse health outcomes. These drinks are a significant and significant source of excessive and unnecessary calory intake (Megally and Al-Jawaldeh, 2020). The consumption of sugar-sweetened beverage (SSBs) is also strongly linked to obesity, along with a host of other negative health consequences (Hu, 2013; Malik, Popkin, Bray, Després, and Hu, 2010a). Strong scientific evidence from prospective studies and randomized controlled trials has implicated regular SSB consumption with an increased risk of long-term excess weight gain for adults and children (Megally and Al-Jawaldeh, 2020; Te Morenga, Mallard, Mann, 2012). This regularly SSBs consumption also caused non-communicable diseases (NCDs) such as diabetes, cardiovascular diseases, cancer, and sugary drinks, which is also a key risk factor for tooth decay in adults and children (Megally and Al-Jawaldeh, 2020; Myers et al., 2017).

Megally and Al-Jawaldeh (2020) cite Del-Ponte et al., 2019 and Johnson et al., 2011, reported that consuming large amounts of sugar can lead to children being affected by health issues such as attention deficit disorder and hyperactivity disorder. These authors further argue that the negative impact of excessive SSBs consumption has also been demonstrated in studies using the Kaufman Brief Intelligence Test, wherein children's cognitive levels were assessed. The results of these tests revealed the verbal scores in mid-childhood decreases. These authors also reported on other studies which showed that children also display other disorders such as not being able to sit still, an inability to concentrate, restlessness and an inability to keep silent. They display a lack of concentration and inattention in that they are unable to complete one activity and jump from one activity without completing any activity.

1.7.9 Public Health Impact of Sugar Intake

Allen and Allen (2020), report that the theoretical frameworks used in obesity prevention programmes rely heavily in favour of ensuring decreased energy intake rather than ensuring increased energy consumption. This is because although exercise and physical activity have

many proven health benefits in weight reduction and general body fitness. Research has revealed that a 30-minute daily run increases energy expenditure by just 5%. In contrast, if an adult consumes a standard bottle of sugar-sweetened beverage (330 millilitres), there is an increase by as much as 11% in the daily total daily kilojoule intake. It has also been proven that there is a strong correlation between an increase in the consumption of SSBs and rising obesity rates, and this is further driven by both an increase in the calorie density and serving size of SSBs. In Australia, for example, Allen and Allen (2020), provide documentary evidence to show that there has been a 30% increase in the consumption of SSBs in the last ten years and that the average serving sizes have also increased substantially over this period.

It has been revealed there is strong evidence to indicate that sugar consumption contributes to a significant increase in the risk of Non-Insulin Dependent Diabetes Mellitus (NIDDM). Several extensive prospective cohort studies have suggested that an increased risk of NIDDM exists amongst people who consume SSBs daily compared to people who rarely consume such beverages (Malik et al., 2010a). One of the negative impacts of excessive sugar consumption in the form of sugar-sweetened beverages is the effect on children's cognition levels. It has been proven that there is a direct correlation between successive sugar consumption and productivity in school performance, productivity and later in life, even income levels become affected (Malik et al., 2010a). It has also been demonstrated, in Australia, that one in two 12-year-old children presents with dental caries in their permanent teeth as a result of free sugar intake (Australian Institute of Health and Welfare, 2016), of which SSBs contributed approximately half this free sugar (Anderson, Dewar and Marshal, Anderson, Cummins, S., Taylor, Dawson, and Sparkset, 2007). Daily consumption of SSBs increases the risk of developing diabetes by 26 % compared with occasional SSBs consumers (Malik et al., 2010a) and SSBs have been implicated in several other non-communicable diseases (Fung et al., 2009).

A typical 330ml serving of an SSB contains approximately ten teaspoons of sugar added during the manufacturing process, whilst fruit juices (200ml) contain 11.5 teaspoons of added sugar (Wang, Coxson, Shen, Goldman and Bibbins-Domingo, 2012). This is about double AHA's recommendation for daily added sugar consumption for men and nearly three times greater than that recommended for women. (Wang et al., 2012). When sugars and syrups are added to SSBs, they increase these beverages' caloric density without contributing any essential nutrients. This can make it difficult for individuals to meet their nutritional needs while staying

within their caloric parameters. Therefore, people gain weight, and in the long-term, they become obese. In a report compiled by Rosinger, Herrick, Gahche and Park (2017), it was shown that 50% of adults and 63% of the youth consumed at least one SSB daily, and Bleich, Barry, Gary-Webb and Herring (2018), found that half of the children aged 2-5 years consumed at least one SSB a day. This consumption, by both adults and children, is problematic as it led to a caloric intake of 150 calories a day, which is about 7.3% and 6.6% of the recommended daily energy intake (Bleich et al., 2018).

This high daily intake of SSBs by young children is a significant risk factor for childhood obesity (Taveras, Gillman, Kleinman, Rich-Edwards and Rifas-Shiman, 2010). Frequent SSB consumption is closely associated with an increased risk of diabetes, metabolic syndrome, weight gain, coronary heart disease (Malik and Hu, 2019), elevated blood pressure (Malik et al., 2010a), and dental cavities (Bernabé, Vehkalahti, Sheiham, Aromaa and Suominen, 2014), and kidney disease (Bomback, Derebail, Shoham, Anderson, Steffen, Rosamond and Kshirsagar, 2010). The risks that increased SSB consumption brings to individuals is further espoused by Jayalath, de Souza, Ha, Mirrahimi, Blanco-Mejia, Di Bouno and Kendall, 2015. These authors reported the results of a six-study cohort meta-analysis that reveals that people who consume one or more SSB a day had a 12% higher risk of developing hypertension than those individuals who never consumed SSBs.

It has been proven in numerous longitudinal studies and clinical trials that innumerable persons have demonstrated an increased risk of gaining weight and becoming obese as a result of increased sugar consumption through the use of SSBs (Megally and Al-Jawaldeh, 2020). These authors also demonstrate that while there is no significant difference in weight gain recorded when sucrose was replaced with low-calorie artificial sweeteners, there was concern that some of these artificially sweetened beverages could increase the risk of diabetes and may also lead to weight gain and obesity.

1.7.10 Economic Costs of Increased Sugar Consumption

Additional to the well-described poor health outcomes associated with excessive sugar consumption which is well-documented, both in terms of obesity and diabetes, it must be noted that the impact of rising rates of obesity and diabetes have a significant economic impact. Allen and Allen (2020) have reported that obesity has cost the Australian government almost AU$ 1500 more in health care subsidies annually for people with NIDDM than people without. It

costs AU$1940 more for those who are both obese and diabetic. Based on these estimates and the rising number of Australians who have been diagnosed with both these conditions, it is estimated that the cost of these diseases is in the region of AU$6.57 billion annually in health care costs. Further to this, based on estimates that were derived from health care cost analyses conducted in 2016, the Grattan Institute estimates that obesity has cost Australia in the region of AU$418 million annually, and more so for people with both obesity and diabetes when compared to those who are not affected, in terms of lost productivity, and an additional AU$57 million in lost tax revenue (Allen and Allen, 2020).

Grimes, Riddell, Campbell, Nowson (2013), reports that children 2-16 years old who consumed more than one SSB daily were 26% more likely to be overweight or obese. It has been estimated that the incremental medical cost of an obese 10-year-old child relative to an average weight child of the same age who maintains normal weight throughout adulthood is US$19,000 (Finkelstein, Graham and Malhotra, 2014).

1.7.11 Healthcare Practitioners Training and Education in Dietary Advice and Health Promotion

As soon-to-be practising healthcare practitioners, the participants in this study will be interacting with and treating patients and communities. They should be able to render holistic healthcare advice, including dietary advice that would contribute to disease prevention, which the researcher terms “nutrition care”. This term “nutrition care” refers to any practice or intervention conducted by a health professional that aims to improve patients' nutrition behaviour and subsequent health and well-being. Nurses and other healthcare practitioners and providers can help prevent and manage chronic disease by providing nutrition care for three reasons. First, they are often the first contact point for individuals with chronic illness who seek health care and advice (Ministry of Health, 2014). Secondly, most people visit a healthcare provider at least once a year, and thirdly these healthcare professionals are trusted and can communicate with patients (Ministry of Health, 2014).

Training in dietary advice and nutrition counselling is taught, in different levels and contexts, to almost all cadres of healthcare professionals (Crowley, Ball, Han, Arroll, Leveritt and Wall, 2015, Glans, 1997); however, it has been reported in many international studies that students receive inadequate nutrition education in medical training (Adams, Kohlmeier and Zeisel, 2010, Walker, 2000). Other research studies report that over 85% of medical students were

not satisfied with their nutrition education (Weinsier, Boker, Feldman, Read and Brooks, 1986).

Khan, Holt and Tinanoff (2017), argue that nutrition training and education has not received adequate emphasis in the training of dentists and oral hygienist. However, it should be an integral part of curricula for oral health professionals. These authors further argue that there is broad recognition of the importance of education and training in nutrition in dentistry because oral health professionals see patients regularly for health maintenance, and frequent sugar consumption is causally linked to the incidence of dental caries.

It has been reported that nutrition education for oral health professionals has failed in course content, number of hours devoted to teaching, faculty preparation, and clinical relevance. As a result, several dental and oral hygiene graduates are likely to be incapable of providing effective nutrition counselling and dietary advice to their patients (Crowley, Ball, Han, Arroll, Leveritt and Wall, 2015; Palmer, 1990).

1.8 Aim and Objectives of the study

Aim

This study aims to undertake a knowledge, attitudes and perceptions study of exit-level health sciences students at a selected university in Durban, South Africa, towards the consumption of sugar-containing beverages following the Introduction of the sugar tax in South Africa to understand how this tax will influence young healthcare professionals who will soon be entering into the healthcare sector as healthcare providers.

Objectives

1. To describe the knowledge of exit-level health sciences students of the sugar tax, and its effects on the beverage industry and its product offerings;
2. To evaluate the attitudes of exit-level health sciences students of the sugar tax, the the beverage industry and its product offerings, and how these attitudes translate into clinical practice;
3. To evaluate the perceptions of exit-level health sciences students towards the sugar tax, the beverage industry and its product offerings, and how these perceptions translate into clinical practice when these professionals are treating, guiding and counselling patients on preventative and curative health treatment;

4. To make recommendations that would lead to newly-qualified practitioners becoming advocates and health-promoters who would pursue a sugar-free/low sugar dietary the regime for both themselves and their patients.

1.9 Research Methodology

1.9.1 Introduction to Research Methodology

This section highlights the methods and materials used to conduct the study. These methods and materials include study design, study population, sampling, setting, data collection methods, data capture and processing.

This section also outlines the phases involved in the study's construction, its location, sample size, study population, participant selection and sampling strategy, data collection methods, the required tools, quantitative data processing, and the ethical qualities taken in this study.

1.9.2 Study Design

A study design is a master plan which directs the research according to its methods and procedures, and by so doing assists in obtaining answers to the research questions posed by the study (Leedy and Ormrod, 2015). A cross-sectional, descriptive and exploratory study design has been employed in the study. It is a cross-sectional study because this exploration was carried out within a particular population group, namely the final year students at a selected UoT.

1.9.3 Study Setting

The study was conducted amongst exit-level health sciences at the Durban University of Technology in Durban, South Africa. The Durban University of Technology is a public higher education facility that trains, amongst others, various cadres of healthcare provision, such as homoeopathy, chiropractic, and nursing and child and youth care.

1.9.4 Study Population and Study Sample

This study was conducted amongst exit-level health sciences at the Durban University of Technology in Durban, South Africa. The sample size was based on a population of 305 students (H.BHS: Chiropractic – 35; B Child and Youth Care, 40; BTech-Emergency Medical

Care – 25; Homoeopathy – 20; Medical Orthotics and Prosthetics – 25; B.HSc: Nursing – 50; B Tech Radiography – 20; B.HSc: Diagnostic Radiography – 50; and Dip: Somatology – 40). Therefore a study sample of 305 was selected. Using a margin of error of 5%, a Confidence Level of 95% and a response rate of 50%, a sample size of 169 participants was calculated using an online sample size calculator (http://www.raosoft.com/samplesize.html).

Purposive sampling techniques were used as the researcher purposively chose this particular population sample because they will be able to provide the information that the researcher requires to achieve the aims and objectives of the study (Kothari, 2004).

1.9.5 Inclusion Criteria

The inclusion and exclusion criteria were designed so that the selection of the candidates was appropriate. The participants were able to provide the necessary data that was required (Leedy and Ormrod, 2015).

- Students who are in the exit-year of a health sciences course at the Durban University of Technology.
- Willing to participate in the study and able to provide the necessary consent.

1.9.6 Exclusion Criteria

- Students who are not in the exit-year of a health sciences course at the Durban University of Technology are post-graduate students or are completing a short-course.
- Students who were not willing to participate in the study and not able to provide the necessary consent.

1.9.7 Pilot study

To ensure the reliability and validity of the study, the researcher conducted a pilot study. This pilot study was conducted amongst 30 persons in their final year of a health sciences course at the Durban University of Technology. These participants were excluded from the final study population.

The pilot study consisted of 10% of the main study population (n=300), with the sample size being 30 participants. These participants were purposively selected to ensure that they represented both males and females; and that they met the inclusion and exclusion criteria of the participants in the main study.

The results of the pilot study, as well as the comments and input received from the participants, were used to inform the researcher of any difficulties experienced by both the participants and the research assistant in understanding the contents of the questionnaires; any ambiguities in the questions; any technical and language difficulties; and any other issues that arose.

1.9.8 Participant Selection and Sampling Strategy

1.9.8.1 Participant Recruitment

Participants were recruited from those exit-level courses that are directly involved in patient diagnosis, care or management. These study fields include Chiropractic; Emergency Medical Care; Homoeopathy; Medical Orthotics and Prosthetics; Nursing; Radiography and Diagnostic Radiography; and Somatology.

After obtaining gatekeeper permission from the Durban University of Technology and final ethical approval from the University of KwaZulu-Natal, the researcher wrote to the various Heads of Departments or Discipline Heads at the Durban University of Technology requesting cooperation in conducting the research using the exit-level cohort. The Heads of Departments/ Discipline Heads were asked to supply the researcher with a class-list. After that, a purposive sample of all the exit-level student, using every 2nd participant based on an alphabetical class list, was selected. These students were contacted via their e-mail addresses and were provided with the information sheet and invited to participate in the study. A second request reminder was sent to the students a week later, and a final follow-up reminder a week later. If no response had been received ten days after the last e-mail request, it was assumed that the student was unwilling to participate in the study. Should a sufficient number of participants not be reached in a specific programme (such as nursing) due to a refusal to participate in the research, the same procedure was applied to select every 2nd student on the remaining list. This procedure continued until the required numbers are obtained.

The same recruitment process was followed until a sufficient sample pool was obtained, or data saturation reached. In all, three rounds of recruitment occurred.

1.9.8.2 Sample Size

This study was conducted amongst exit-level health sciences at the Durban University of Technology in Durban, South Africa. The sample size was based on a population of 150

students (H.BHS: Chiropractic – 20; B Child and Youth Care, 10; BTech-Emergency Medical Care – 20; Homoeopathy – 15; B.HSc: Nursing – 30; B Tech Radiography – 20; B.HSc:Diagnostic Radiography – 20; and Dip: Somatology – 15).

Therefore a study sample of 150 was selected. Using a margin of error of 5%, a Confidence Level of 95% and a response rate of 50%, a sample size of 70 participants was calculated using an online sample size calculator (http://www.raosoft.com/samplesize.html).

1.9.8.3 Data Collection Tools / Methods and Data Analysis

Participants were recruited from those exit-level courses that are directly involved in patient diagnosis, care or management. These study fields include Chiropractic; Emergency Medical Care; Homoeopathy; Medical Orthotics and Prosthetics; Nursing; Radiography and Diagnostic Radiography; and Somatology. A purposive sample of all the exit-level students, using every 2nd participant based on an alphabetical class list, was selected. Should a sufficient number of participants not have been reached in a specific programme (such as nursing) due to a refusal to participate in the research the same procedure was then applied to select every 2nd student on the remaining list. This procedure continued until the required sample size was reached.

Participants were invited via social media and e-mail to participate in the research. A LINK TO A Microsoft Forms survey tool was sent to the participants. All the information about the study was explained to the participants in the information sheet and consent forms. The selected participants were then asked to consent to the research and then continue participating in the survey. The following information was contained in the questionnaire: - sociodemographic profile, knowledge of the sugar tax and SSBs, attitudes towards the sugar tax and SSBs, and perceptions of their practices relating to dietary advice and the sugar tax.

Upon completing the data collection, the qualitative data was entered into a Microsoft Word® document, placed into themes. Then the content was thematically analysed using the NVivo Statistical Analysis Programme to generate descriptive and analytical statistics.

The NVivo programme organise and the analysed the non-numerical or unstructured data, and then allowed the researcher to classify, sort and arrange the information; examine relationships in the data related to for example residence of the participant and SSB consumption; and then

allowed for an analysis of these relationships through the processes of linking, shaping, searching and modelling. The themes identified included amongst others food purchase habits, mindsets, willingness to change own dietary habits, and own preference. The quantitative data was analysed using the Statistical Package for Social Sciences data analysis software, and the results are presented as bar graphs, pie graphs, line graphs and tables. Pearson's Chi-squared tests were used, and statistical significance was set at $P \leq 0.05$.

The captured data was entered into a Microsoft Excel spreadsheet and was analysed using the Statistical Package for the Social Sciences (SPSS) (version 25). The data was also cleaned to eliminate inaccuracies and was summarised and presented using descriptive statistics, including standard deviation and mean percentage for most variables where applicable. The data were analysed using the Chi-squared test (CI – 95%), and the results are presented by making use of tables, bar graphs, line graphs and linear graphs

1.9.8.4 Reliability and Validity

The study's reliability was ensured by using only the researcher for data collection, thus ensuring that all data be collected in the same way. Also, reliability was further confirmed by utilising internal consistency, thereby ensuring that the same, clear, relevant and unambiguous questions were administered to the participants in a similar manner to produce similar results. To ensure validity, the questionnaire had been reviewed by the supervisor and the research ethics committee, to ensure that it captures the information it intends to. Therefore, the questionnaire was pre-tested amongst a similar target group. Upon pre-testing, the necessary amendments and corrections were made to improve the reliability of the questionnaire

Validity

To ensure validity, both internal and external validity was maintained.

Internal Validity

The questionnaire was assessed by senior experienced researchers regarding content, structure, purpose, and grammar to ensure that the questions are valid.

External Validity

The study was restricted to the exit-level health sciences students, and as such, it may not be generalized and extend beyond its study population.

1.9.8.5 Value of study

The knowledge gained from this study will be made available to the Department of Health, Department of Higher Education, the Durban University of Technology Health Science Faculty and other stakeholders, and training institutions. It is envisaged that these stakeholders can use this knowledge to introduce initiatives and interventions and policy reforms that could encourage young health professionals to render appropriate nutrition and dietary counselling, especially surrounding SSBs to their patients. It may also help international counterparts undertake cross-national comparatively analyse interventions, strategies and policy-initiatives that could lead to improved population health outcomes.

1.10 Ethical considerations

1.10.1 Independent ethics review

Before applying for ethical clearance from the Biomedical Research Ethics Committee (BREC) of the University of KwaZulu-Natal, the researcher enrolled and completed compulsory Researcher Ethics Training Certificate courses (see appendix). Thus, the required ethical considerations were adhered to both before and during the study.

This study protocol was submitted to the Biomedical Research Ethics Committee (BREC) of the University of KwaZulu-Natal for ethical review, and subsequently, ethical clearance was issued. Ethical approval was obtained from the Biomedical Research Ethics Committee (BREC) of UKZN. Ethical approval was issued, with Reference number: BREC/00001337/2020.

1.10.2 Informed consent

Detailed information regarding the study was fully explained to allow participants to make voluntary informed decisions before consenting to participate in the study. Thereafter the participant information sheet and informed consent forms were administered online to those who volunteered to participate in the study. Information about the purpose, benefits and possible risks of the study were presented in a simple, brief and easily understandable language without jargon. The participants were also informed of the right to withdraw from the study if they wish so without any penalty.

1.10.3 Ongoing respect for participants

The data collected has been stored in safekeeping in a tamper-proof cupboard, in the research supervisor's office at the University of KwaZulu-Natal, Westville campus. Any information that could have led to the study participants' identification was replaced with coding values and stored on a password-protected USB flash drive. All the hard copies of data will be destroyed by shredding. Electronic data will be destroyed by overwriting and double-deleting five years after the study has been completed and published. All the parties that have contributed and participated in the survey will be acknowledged in the final report.

1.10.4 Methodological challenges and study limitations

Due to Covid-19 students were not on campus, and the study had to be conducted electronically. However, every effort was made, and through the use of social media and networking to locate the target population and all participants were reached. Lastly, the results cannot be generalized to all health professional training facilities as there may be region-specific reasons and factors that influence healthcare professionals in managing patients.

1.10.5 Dissemination of results

The results, outcomes and recommendations of this study will be disseminated via peer-reviewed journal articles and conference presentations. Additionally, it is essential that this investigation's results also be communicated to the various stakeholders, such as the Provincial and Local Departments of Health, Universities and other training institutions and other stakeholders, to review the results and recommendations, adopted and considered for future policy changes.

1.10.6 Summary

This section outlined the methodology applied in the study to accomplish its aim and objectives. It describes the study design, the setting, data collection tools used and the process for data collection and analysis of the data and assisting in answering the research questions. It also addressed the ethical considerations the study needed to adhere to.

Chapter 2: Manuscript Presentation

This chapter presents the manuscript that has developed for submission to an accredited peer-reviewed journal.

"Knowledge, Attitudes and Practices of Exit-Level Health Sciences Students at a Selected University in Durban, South Africa, towards the Consumption of Sugar-containing Beverages Following the Introduction of the Sugar Tax in South Africa"

Lavern Samuels[1]
Tufayl Ahmed Muslim[2]

Authors' Affiliations

Lavern Samuels[1]: Dip OH (MEDUNSA), Adv. Dip Com Dent (SMU), PGDip Public Health (UWC). Discipline of Dentistry, School of Health Sciences, University of KwaZulu-Natal

Tufayl Ahmed Muslim[2]: B Dent Ther (UKZN), MSc (Dental Public Health)(UWC), MTech (Qual)(DUT), PhD (UKZN)

Corresponding author:
Tufayl Ahmed Muslim: B Dent Ther (UKZN), MSc (Dental Public Health)(UWC), MTech (Qual)(DUT), PhD (UKZN)
Acting Academic Leader and Lecturer: Discipline of Dentistry, School of Health Sciences, University of KwaZulu-Natal
Private Bag X54001, Durban, 4000,
Tel: 031-2608068, Fax: 031-2608068
E-mail: muslimt@ukzn.ac.za

Introduction

The sugar tax was implemented in South Africa to increase the price of food products containing sugar in an attempt at reducing the consumption of sugar, hoping that this reduced sugar consumption will lead to a reduction in obesity and in diseases that have sugar as a causative agent. Healthcare professionals can play a critical role in advising patients on reducing sugar intake, especially with reduced consumption of sugar-sweetened beverages.

Aim and objectives

This study aimed to determine the knowledge, attitudes and practices of knowledge, attitudes and practices of exit-level health sciences students at a selected University in Durban, South Africa, towards consuming sugar-containing beverages following the introduction of a sugar tax.

Methods

Gatekeeper permission was obtained from the Durban University of Technology and final ethical approval from the University of KwaZulu-Natal. Information about the study was made available using an information sheet to 150 final-year students in the health sciences professions (nursing, child and youth care, chiropractic, emergency medical care, homoeopathy, radiography and somatology), and consent was obtained. A link to a Microsoft forms survey tool was sent to participants via e-mail and social media platforms such as WhatsApp. An online self-administered questionnaire was sent to the participants. It included questions around participants sociodemographic profile, knowledge of the sugar tax and SSBs, attitudes towards the sugar tax and SSBs, and perceptions of their practices relating to dietary advice and the sugar tax. Qualitative data were analysed using NVivo, and quantitative data using the Statistical Package for the Social Sciences (SPSS) (version 25).

Results

The study population consisted of a young population with the mean age being 23.6 years. Most participants (60.4%, n=40, p .101707 – not significant), left the purchasing and food-choice decisions to their parents. Most participants (n=39, 59%) reported that they had changed their SSBs consumption habits. Most) participants (78.2%, n=51) were not aware of the sugar tax's purpose and its introduction.

Participants were mostly positive 61% (n=40) on their attitudes towards the merit of the implementation of a sugar tax, but 21 participants (32%) had a negative view of this tax, citing

reasons such as that “even with an increase of the sugar beverages price, consumption will not decline.” The sugar tax theme was an excessive burden placed on an already over-taxed society, and a violation of personal and constitutional rights was forwarded by 27% (n=18) of the participants who supported the sugar industries anti-sugar tax stance.

Only 24% (n=16) believed they had not received sufficient education and training around sugar consumption containing beverages. Participants reported having had minimal training, lacking in-depth and current literature pertaining to SSBs consumption.

Conclusion

This study raises several important questions regarding nutritional training among the various cadres of health sciences students at higher learning institutions. According to the results, it appears that there is a need for curriculum reform that would lead to improved training in diet and nutrition advice content so that future health professionals will be more aware of the current trends and practices pertaining to diet and nutrition, and thus be able to offer their clients/patients holistic health management and treatment course of care. Extensive curriculum reform and redesign should occur, in that extensive training and education be given to all Health Sciences students and future healthcare workers about the ill effects of excessive sugar consumption, and that they are trained in being able to render dietary counselling and advice to the prospective patients

Keywords: sugar tax, healthcare professionals, sugar-sweetened beverages

Introduction

The sugar tax was implemented in South Africa to increase the price of food products containing sugar in an attempt at reducing the consumption of sugar, hoping that this reduced sugar consumption will lead to a reduction in obesity and in diseases that have sugar as a causative agent.

Since the introduction of the sugar tax, several actions have occurred within the industry that requires sugar in the production of its food products. One of the largest users of sugar is the cold-drink beverage industry. We have since seen the introduction, or ramping up, of beverages that contain either no (termed "zero" by the market) or reduced (termed "diet") cold-drinks, sports-drinks, and other beverages.

The South African government has, in the recent past, introduced various policy initiatives that are aimed at health and environment protection and improvement. Whilst some of these initiatives are aimed at environmental protection, others have a focussed approach on oral and general health.

A tax that would have significant ramifications for oral health, in particular, is the so-called sugar tax, which was levied on manufacturers at a rate of 11%, based on the sugar content. This tax will raise the manufacturing cost price, and manufacturers will consequently seek to recover these increased costs from the end-consumer by increasing the cost prices of products that they sell to wholesalers and retailers. Officially called the "Health Promotion Levy", this tax has resulted in South Africans paying more for sugary drinks from 01 April 2018. It amounts to a tax of 2.1c per gram of sugar per 100ml, above 4 grams per 100ml (Manyema, Veerman, Chola, Tugendhaft, Sartorius, Labadarious and Hofman, 2014; National Dept. of Health, 2013).

The term "sugar" as used in the concept of the sugar tax, is a misnomer as the tax is not levied on solid sugar or sugary substances but rather on sugar-sweetened beverages (SSBs) (Fung, Malik, Rexrode, Manson, Willet, and Hu, 2009). These beverages contain added-caloric sweeteners such as sucrose, high-fructose corn syrup, or fruit juice concentrates. The health promotion levy aims to fund health promotion activities that would reduce obesity rates and improve population health outcomes (National Dept. of Health, 2013). This is essential when one notes that there has been a reduction in the number of tobacco users and the incidence of tobacco-related diseases since the introduction of raised tobacco taxes and anti-smoking

policies. It is envisaged that the sugar tax could have similar implications on oral and general health standards (Backholer and Martin, 2017).

South Africa has the dubious reputation of being one of the top three countries in obesity rates. The alarming sugar consumption rates put South Africa amongst the top 10 soft-drink consumers globally (National Dept. of Health, 2013). Scientific evidence has demonstrated the association between sugar consumption and certain chronic diseases (National Dept. of Health, 2013). Whilst acknowledging that many non-dietary factors play a role in chronic diseases it is noted that obesity is one of the five risk factors for early death, with 43% of deaths in South Africa being attributed to obesity-related chronic diseases (such as heart disease, stroke and some cancers) (National Dept. of Health, 2013).

It is envisaged that the implementation of the sugar tax will lead to a reduction in soft-drinks consumption, with the associated decrease in the rate of caries and improved oral and general population health status (Manyema et al., 2014). In 2014 the sugar tax policy (at a rate of 10%) was introduced in Mexico, and a 6% decline in sugary drink purchases was evident in the first year (Backholer and Martin, 2017).

Internationally, despite the political will to introduce a sugar tax being vociferous, there is stiff opposition presented by the beverage industry (Backholer and Martin, 2017). This is understandable considering that sugarcane's global production outweighs any other crop (McKay, Sauer, Richardson and Herre, 2016).

In Mexico, where the sugar tax was proposed in 2013, there were aggressive industry-funded media campaigns against the tax's introduction, and so too was their opposition in the United States (Myers, Fig, Tugendhaft, Mandle, Myers and Hofman, 2017). Excessive sugar consumption is an international public health concern (Megally and Al-Jawaldeh, 2020; Myers et al., 2017). It is a well-established fact that sugar-sweetened beverage consumption is related to several adverse health outcomes. These drinks are a significant and significant source of excessive and unnecessary calory intake (Megally and Al-Jawaldeh, 2020). Strong scientific evidence from prospective studies and randomized controlled trials have implicated regular SSB consumption with an increased risk of long-term excess weight gain for both adults and children (Megally and Al-Jawaldeh, 2020; te Morenga, Mallard, and Mann, 2012), as well as associated non-communicable diseases (NCDs) such as diabetes, cardiovascular diseases,

cancer and the consumption of sugary drinks is also a key risk factor for tooth decay in both adults and children (Megally and Al-Jawaldeh, 2020; Myers et al., 2017).

Megally and Al-Jawaldeh (2020) cite Del-Ponte et al., (2019), and Johnson et al., (2011), as having reported that consuming large amounts of sugar can lead to children being affected by health issues such as attention deficit disorder and hyperactivity disorder. These authors further argue that the negative impact of excessive SSBs consumption has also been demonstrated in studies using the Kaufman Brief Intelligence Test, wherein children's cognitive levels were assessed. The results of these tests revealed the verbal scores in mid-childhood decreases. These authors also report on other studies wherein It has been reported that children also display other disorders such as not being able to sit still, an inability to concentrate, restlessness and an inability to keep silent.

In South Africa, the National Department of Health in 2013 reported that NCDs account for 40% of all deaths, 60% of 6-year-olds have tooth decay, and 98% of 44-year-olds have gum disease and that South Africa ranks number eight worldwide for sugar consumption (Myers et al., 2017). According to the South African Sugar Association (SASA), the average South African consumed 36.4kg of sugar in 2012-2013 (SASA, 2013; SASA, 2019). Daily consumption of SSB increases the risk of developing diabetes by 26 % compared with occasional SSB consumers (Malik, Popkin, Bray, Despres, HU., 2010) and SSB has been implicated in several other non-communicable diseases (Fung, Malik and Rexrode, Manson, Willet, and Hu, 2009).

Future healthcare professionals are the ideal advocates for a change in all their patients' diet and nutrition. As part of their holistic management of patients, healthcare practitioners should encourage patients and communities to decrease SSB consumption. This has the potential of contributing to improved overall health outcomes.

Methods

A cross-sectional descriptive qualitative and quantitative study was conducted. Amongst exit-level health sciences at the Durban University of Technology in Durban, South Africa. The sample size was based on a population of 150 students (Bachelor of Health Sciences: Chiropractic – 20; Bachelor of Child and Youth Care, 10; Bachelor of Technology - Emergency

Medical Care – 20; Bachelor of Technology - Homoeopathy – 15; Bachelor of Health Sciences: Nursing – 30; Bachelor of Technology - Radiography – 20; Bachelor of Health Sciences: Diagnostic Radiography – 20; and Diploma in Somatology – 15).

Gatekeeper permission was obtained from the Durban University of Technology and final ethical approval from the University of KwaZulu-Natal. Appropriate information was made available to participants, and consent was obtained. An online questionnaire was administered to the participants. It included questions around participants sociodemographic profile, knowledge of the sugar tax and SSBs, attitudes towards the sugar tax and SSBs, and perceptions of their practices relating to dietary advice and the sugar tax.

Upon completing the data collection, the qualitative data was entered into a Microsoft Word® document, placed into themes, and thematically content analysed using the NVivo Statistical Analysis Programme to generate descriptive and analytical statistics. The quantitative data was analysed using the Statistical Package for Social Sciences data analysis software, analysed using the Chi-square testing methods to determine significance, and analysed for correlations between variables. The results are presented as bar graphs, pie graphs, line graphs and tables.

Results

This research study's participants are a cohort of final-year health sciences students at the Durban University of Technology over the year 2020. The results of the survey are presented below:

Demographics: The study population consisted of a young population with the mean age being 23.6 years [SD:2.3], (Range: 20-38). This can be attributed to the fact that most students in an undergraduate programme are recent school-leavers, and this cohort consists of students in their final year of a 3- or 4 -year programme of study.

Most participants (59%, n=39, statistically insignificant p-value of .010909) were female, and 5 participants (7%) were married with the rest being single and never married. Most participants lived at home before studying at university (95.5%, n=63), and almost half (55%, n=36) lived in an urban area. An almost equal spread of participants either lived at home (28.8%, n=19); with friends/in a commune (33.3%, n=22); and 25% (n=37) resided in student residences. Most participants (60.4%, n=40, p .101707 – not significant), left the purchasing and food-choice decisions to their parents, whilst 36.5% (n=24) purchased their own food. Only two participants had their meals catered for.

Income plays a role in food choice, and the income levels of the participants' families are presented in the following graph:

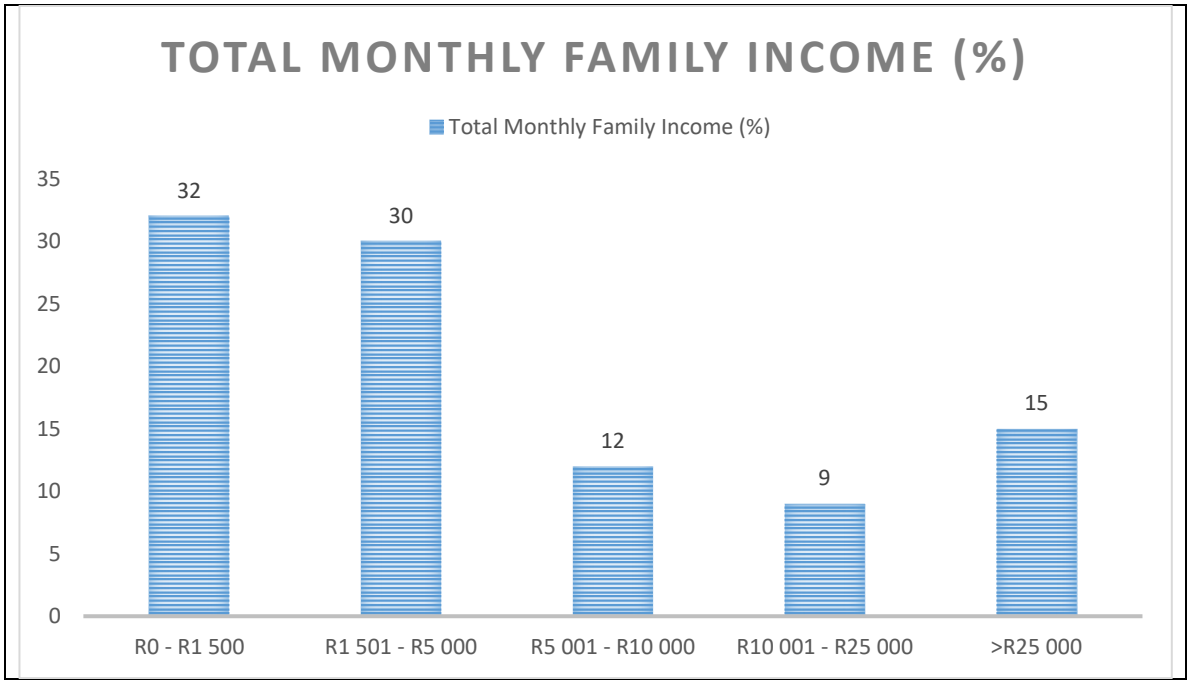

Figure 2.1: Participants family income levels

Nursing was the predominant profession, and the career choices of the participants are reflected below:

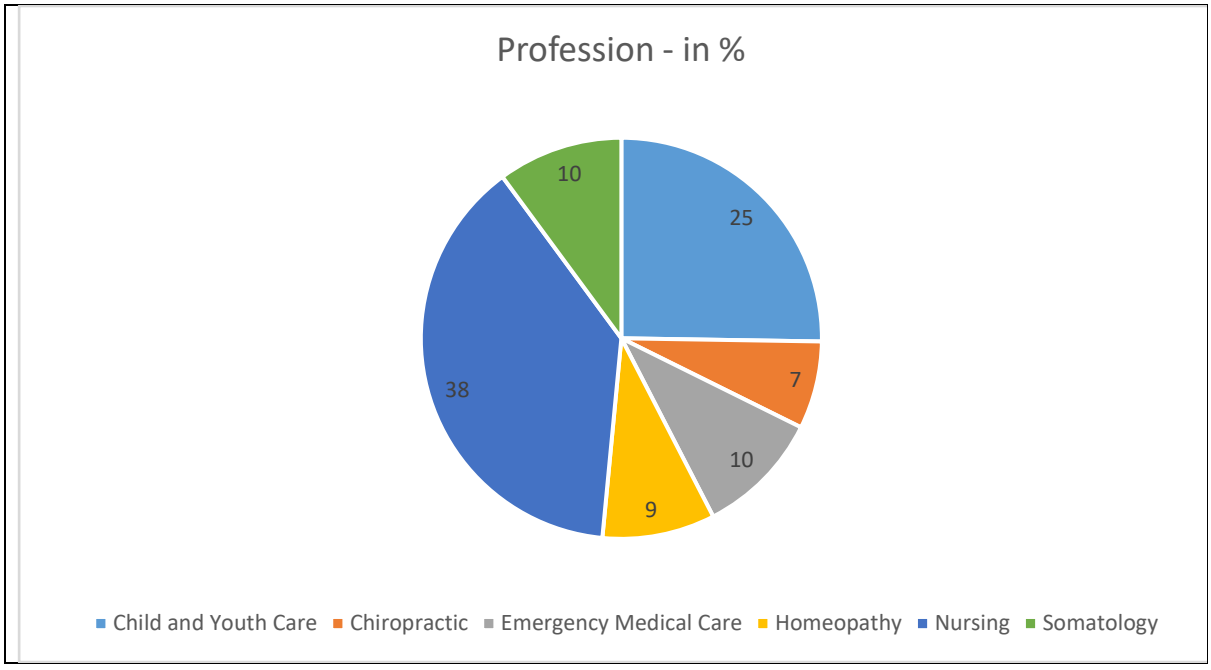

Figure 2.2: Career choice of participants

Sugar Tax Concerns:

In response to the question" Have you changed to drinking low-sugar or sugar-free beverages since the introduction of the sugar tax, and why?" a variety of responses were received. Several participants (n=11, 16.7%) reported that the sugar tax introduction was not of concern to them as they did not consume SSBs. Two of these participants did not consume SSBs because they were sensitive to the preservatives they contain, whilst five stated that they always only drank water because of health and weight loss/maintenance reasons. Of those 16 (24%) participants who indicated that they had not changed their SSBs consumption habits six reported being unaware of the tax as the reasons for not changing. Five participants stated that they would not change and offered reasons such as: "sugar drinks taste better," "I prefer the original;" and "because I love sugar".

The majority of the participants (n=39, 59%) who reported that they have changed their SSBs consumption habits offered the following reasons for doing so; disease prevention (specifically diabetes) – n=18; the improved taste of sugar-free beverages - n=1; and calorie reduction as part of a diet –n= 6. Only a single participant mentioned that the price of SSBs was a push-factor.

Interestingly, 37.9% (n=25) of the participants were not aware that South Africa had implemented a sugar tax, and 19.7% (n=13) were uncertain. Most (78.2%, n=51) participants were not aware of the sugar tax's purpose and its introduction.

Participants were questioned on their attitudes towards the merit of the implementation of a sugar tax, and 61% (n=40) were positive about this, with some candidates suggesting that the tax could help curb the high rates of diabetes mellitus, obesity and improve general health status as the health crisis of high sugar intake, particularly in South Africa, is a significant concern to the healthcare sector. In contrast, 7% (n=5) of the research participants were uncertain of whether the implementation of this tax would have any effect, and 21 participants (32%) had a negative view of this tax, citing reasons such as that "*even with an increase of the sugar beverages price, consumption will not decline. Instead, much more harmful products (illicitly produced and out of the tax-income generation sphere) will be produced and sold at much cheaper costs*" [Participant A]. The attitude of one participant, who stated that "*people should be free to have whatever they like. South Africa is a free country we should not stop people from indulging in their wants as many of us work hard to get what we want* [Participant F]" is

of sobering concern and might warrant further research into the attitudes of healthcare workers toward this perceived imposition and affront of and on their, and patients and citizens, perceptions of the sugar tax, and other health-related intervention, as an attack on their personal and constitutional rights.

Of further concern is the participant's' responses to the question related to their support for, or against, the sugar and beverage industry's resistance towards the sugar tax. The theme of the tax being an excessive burden placed on an already over-taxed society, and a violation of personal and constitutional rights once again comes to the fore. Arising from the negative responses of 27% (n=18) of the participants who supported the sugar industries anti-sugar tax stance, are the major thematic arguments of 1) The economic benefits of the sugar industry and the negative impact that the sugar tax would have on the financial viability and profitability of this industry; and 2) the imposition of the tax as a violation of consumers constitutional rights to freedom of choice. These views are reflected in the response of several candidates, and are expressed in some of the responses as presented below:

- *Sugar cane is grown naturally* [Participant B].
- *I support this resistance from the sugar industry as it plays a significant role in baking and food industries and generates large taxes for the government* [Participant C].
- *My family members work in the sugar industry and would lose their jobs because*
- *of this tax* [Participant D].
- *People should be free to drink what they want* [Participant J].
- *It seems like we are now being taxed on everything, like literally everything* [Participant K].

In contrast, most of the participants (73%, n=48), supported this tax. They cited several reasons for this, and these can be thematically reported as being of: - 1) economic concerns; and 2) health promotion and prevention concerns. One participant argued that the sugar industry resisted the sugar tax based on a profit-generation position and commented that their stance needs to align with public health and safety first. Another participant suggested that it would be better for the sugar industry to invest in finding healthier alternatives (to sugar). One participant stated that the sugar industry's resistance has contributed to an increase in the prevalence of obesity and non-communicable diseases.

The participants' responses raise concerns about the levels of training and education in matters of diet and nutrition. The research participants were then asked if they were confident that they had received sufficient education and training around diet and nutrition to advise their future patients regarding the consumption of sugar-sweetened beverages. Only 24% (n=16), believed that they had not received sufficient education and training in terms of render health care and dietary advice to their future patients regarding the health benefits, or lack thereof, around the consumption of sugar-containing beverages. Participants reported having had minimal training, lacking in-depth and current literature pertaining to SSBs consumption. One participant reported that "*I do feel this topic has been discussed and covered over my many years of studies, but the gravity and impact have not been imparted - rather my own research has shown the severity of the sugar crisis*" [Participant J].

Most participants (76%, n=50) opined that they had received sufficient training and education. One participant reported that "*since I know the risks and complications associated with too much consumption of sugar I will educate my patients about excessive sugar consumption even though I do not have the final say over a patient's diet, even though we can try to inform them of the dangers of eating poorly*" [Participant K]. Another participant stated that, due to the knowledge that she had gained from being educated about the effects of excessive sugar intake as part of her undergraduate education and training, she has "*already started minimizing intake of food high in sugar"* [Participant L].

Some of the general feelings towards the sugar tax and its implementation were voiced by the research participants as follows:

- "*Sugar tax will contribute towards the control of a burden of chronic diseases including diabetes mellitus*" [Participant M].
- '*The sugar tax should not be implemented in our country because it is a daily use, like bread, milk, we can't live without sugar, and this tax will raise its cost what will happen to poor families*?" [Participant N].
- "I *suggest the government limit the taxing. We can't be taxed in everything now really*!" [Participant O].

Participants also voiced their concerns about the need for increased training, education and oral health promotion efforts related to the health effects of increased sugar consumption, primarily through the consumption of excessive amounts of SSBs. One participant suggested that

campaigns should be implemented in all schools and universities to fight against high consumption of sugar and SSBs.

Despite the number of participants indicating an understanding of the negative impact of high levels of sugar and SSBs consumption it is of concern to the researchers that 6% (n=4) of these future healthcare practitioners stated that they would not educate patients about the adverse effects of high levels of SSBs consumption. We attribute this to possible resistance to the state and its health and taxation policies, or on a personal level having family members employed in the sugar industry and being fearful of the impacts of the economic losses that decreased sugar and SSBs consumption could bring.

Discussion

This study raises several important questions regarding nutritional training among the various cadres of health sciences students at universities and technology universities. According to the results, it appears that there is a need for curriculum reform that would lead to improved training in diet and nutrition advice content so that future health professionals will be more aware of the current trends and practices pertaining to diet and nutrition, and thus be able to offer their clients/patients holistic health management and treatment course of care. A key finding of the current study is that despite mass media campaigns both against and in support of the tax, as well the accompanying news coverage around the Health Promotion Levy over long periods many participants were mostly unaware of the sugar tax and its implementation (Healthy Living Alliance, 2017).

Katz (2018) argues that considering the "potency and ubiquity of dietary influences on health, all in "health care" are nothing less than duty-bound to address this topic to the best of our ability.' Therefore, it is comforting to note that 94% of the participants agreed that they would institute health promotion and nutrition advice programmes into their patient treatment and management plans upon graduation. Katz (2018) further argues that nutrition must be addressed routinely in clinical practice, whether by a singular practitioner or as a team effort.

As participants became aware of the sugar tax, some participants indicated cynicism about the government's motives for the tax and their belief that this tax is imposing on their constitutional right to freedom of choice. However, the study was limited by the sample, including

participants from a single university and included only a small selection of future healthcare practitioners.

Conclusion: It is evident from the research results that several considerations need to be affected to improve adherence to help promotion efforts that could decrease sugar consumption, especially the consumption of SSBs.

Recommendations

Extensive curriculum reform and redesign occur. Comprehensive training and education be given to all Health Sciences students and future healthcare workers about the ill effects of excessive sugar consumption. They are trained in being able to render dietary counselling and advice to prospective patients. More attention should be given to the prioritisation of the health education and training of future and existing health care practitioners to ensure that they are satisfactorily positioned to provide health care advice to the patients and the public that would lead to an understanding of the adverse effects of high sugar consumption, especially as in the consumption of hidden sugars that one may find in SSBs. It is envisaged that such training and education, as well as increased health promotion efforts by all stakeholders, including local and national health departments and other health care advocacy groups, would lead to a decline in the per capita sugar consumption rates end subsequently declines in obesity and other lifestyle conditions such as diabetes.

There should be significant education and behaviour changing campaigns and programs aimed at educating both health care providers and patients in the caregivers and adults and children in general, about appropriate choices of beverages and encouraging water consumption as an alternative to SSBs.

Acknowledgement

The researchers would like to extend their gratitude to all students who participated in the study.

Conflict of interest

None declared

REFERENCES

Backholer, K., Martin, J. (2017). Sugar-sweetened beverage tax: the inconvenient truth. Public Health Nutrition: 20(18), 3225–3227. Available at: https://www.cambridge.org/core/journals/public-health-nutrition/article/sugar-sweetened-beverage-tax-the-inconvenient-truths/C48613EFA36606E6EF36597FE422306A. [Accessed 07August 2020].

Fung, T.T., Malik, V., Rexrode, K.M., Manson, J.E., Willet, W.C., and Hu, F.B. (2009). Sweetened beverage consumption and risk of coronary heart disease in women. Am J Clin Nutr 89, 1037–1042. Available at: https://pubmed.ncbi.nlm.nih.gov/19211821/. [Accessed 21 March, 2020].

Katz, D.L. (2018). How to Improve Clinical Practice and Medical Education About Nutrition. *AMA Journal of Ethics*: 20,**10**: E994-1000. Available at: https://www.researchgate.net/publication/328462598_How_to_Improve_Clinical_Practice_and_Medical_Education_About_Nutrition. [Accessed 21 March 2020].

Malik, V.S., Popkin, B.M., Bray, G.A., Despres, J.P. Hu. F.U. (2010). Sugar-sweetened beverages, obesity, type 2 diabetes mellitus, and cardiovascular disease risk. Circulation, 2010; 121:1356-64. Available at: https://www.ahajournals.org/doi/full/10.1161/CIRCULATIONAHA.109.876185. [Accessed 07August 2020].

Manyema, M., Veerman, L.J., Chola, l., Tugendhaft, A., Sartorius, B., Labadarious, D. and Hofman, K.J. 2014. The Potential Impact of a 20% Tax on Sugar-Sweetened Beverages on Obesity in South African Adults: A Mathematical Model. PLOS ONE, 9(8), 1-10. Available at: https://pubmed.ncbi.nlm.nih.gov/25136987/. [Accessed 21 March 2020].

McKay, B., Sauer, S., Richardson, B, Herre, R. (2016). The political economy of sugarcane flexing: initial insights from Brazil, Southern Africa and Cambodia. The Jnrl of Peasant Stud, 43(1); 195-223. Available at: https://www.tandfonline.com/doi/abs/10.1080/03066150.2014.992016. [Accessed 07August 2020].

Megally, R., Al-Jawaldeh, A. (2020). Impact of sin taxes on consumption volumes of sweetened beverages and soft drinks in Saudi Arabia. F1000 Research, 9:1117. Available at: https://f1000research.com/articles/9-1117. [Accessed 21 March 2020].

Myers, A., Fig, D., Tugendhaft, A., Mandle, Myers, J., Hofman, K. (2017). Sugar and health in South Africa: Potential challenges to leveraging policy change. Global Health Policy. 12(1), 98-115. Available at: https://pubmed.ncbi.nlm.nih.gov/26315455/. [Accessed 21 March 2020].

National Department of Health. (2013). Strategic Plan for the Prevention and Control of Non-Communicable Diseases 2013-17. Pretoria, South Africa: NDOH. Available at: https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/55630/IDL-55630.pdf?sequence=1. [Accessed 21 March 2020].

South African Sugar Association [SASA] Official website. (2019). Available at http://www.sasa.org.za/. [Accessed 21 March 2020].

South African Sugar Association [SASA] Official website. (2013). Available at http://www.sasa.org.za/. [Accessed 21 March 2020].

te Morenga, L., Mallard, S., Mann, J. (2012). Dietary sugars and body weight: systematic review and meta-analyses of randomised controlled trials and cohort studies. BMJ 346, e7492 Available at: https://www.bmj.com/content/346/bmj.e7492. [Accessed 07August 2020].

2.2 Summary

This chapter presented the journal article developed from the study and will be submitted to a peer-accredited journal. The developed journal article addressed the aim and all the objectives of the study.

CHAPTER 3: Concluding Chapter

3.1 Introduction

This chapter presents an analysis of how the aims and objectives of the study were addressed. An outline of the study limitations is presented. This is followed by a statement related to the significance of the study. The chapter concludes with a set of recommendations.

3.2 Study Strengths and Limitations

In a study of this nature, there are bound to be evident and hidden factors that could affect the study. The study had several limitations, including that the study concentrated on a cohort of students, who, it is assumed, are young and ambitious and may have a different diet from their patients. It is suggested that a different set of results may have been achieved if the study population was older and more mature.

Another limitation is that the study is only conducted at a single University of Technology, and in a single province in South Africa. The results may not be transferable to other training institutions. This does not allow for the results to be generalised provincially and nationally.

3.3 Significance of the Study

The study provided valuable insight into the knowledge, attitudes, and perceptions of young healthcare professionals about their understanding of the sugar tax and their dietary habits, diet and nutrition advice to patients and their clinical practices. It is envisaged that these young professionals will realise the importance of advising patients on reducing SSB intake, thus possibly ensuring improved patient healthcare outcomes.

3.4. Achievement of Aims and Objectives

This study aims to undertake a knowledge, attitudes and perceptions study of exit-level health sciences students at a selected university in Durban, South Africa, towards the consumption of sugar-containing beverages following the Introduction of the sugar tax in South Africa to understand the effects of this tax on young healthcare professionals who will soon be entering into the healthcare sector as healthcare providers. The aim of the study was achieved through the fulfilment of the objectives, as shown below.

Objectives

1. To describe the knowledge of exit-level health sciences students of the sugar tax, and its effects on the beverage industry and its product offerings.
2. To evaluate the attitudes of exit-level health sciences students of the sugar tax, the beverage industry and its product offerings, and how these attitudes translate into clinical practice.
3. To evaluate the perceptions of exit-level health sciences students towards the sugar tax, the beverage industry and its product offerings, and how these perceptions translate into clinical practice when these professionals are treating, guiding and counselling patients on preventative and curative health treatment.
4. To make recommendations that would lead to newly qualified practitioners becoming advocates and health-promoters who would pursue a sugar-free/low sugar dietary the regime for both themselves and their patients.

How were the Objectives Achieved?

The study had four objectives to achieve its aim. These were: 1) To describe the knowledge of exit-level health sciences students of the sugar tax, and its effects on the beverage industry and its product offerings, 2) To evaluate the attitudes of exit-level health sciences students of the sugar tax, the beverage industry and its product offerings, and how these attitudes translate into clinical practice; 3) To evaluate the perceptions of exit-level health sciences students towards the sugar tax, the beverage industry and its product offerings, and how these perceptions translate into clinical practice; and the last objective was to make recommendations that would lead to newly-qualified practitioners becoming advocates and health-promoters who would pursue a sugar-free/low sugar dietary regime for both themselves and their patients.

The results of Objective 1, which was to describe the knowledge of exit-level health sciences students of the sugar tax, and its effects on the beverage industry and its product offerings, was achieved as students provided data related to their knowledge of the sugar tax, its impact on the industry and product offerings. It should be noted that this study did not target health professions that were not directly related to the oral health sciences (e.g., dental assistants, dental therapists, oral hygienists, dentists) as these practitioners are aware of the role that excessive sugar consumption plays in the dental disease process and are expected to counsel their patients on the effects of excessive sugar consumption.

Regarding Objective 2 and 3, which was to evaluate the attitudes and perceptions of exit-level health sciences students of the sugar tax, the beverage industry and its product offerings, and how these attitudes translate into clinical practice was also achieved as students voiced their opinions and concerns about some issues related to the sugar tax and its implementation.

Objective 4, which was to make recommendations that would lead to newly-qualified practitioners becoming advocates and health-promoters who would pursue a sugar-free/low sugar dietary regime for both themselves and their patients was also achieved as a series of recommendations have been made.

3.5 Recommendations

The following recommendations arise out of the study: -

1. Extensive curriculum reform and redesign occur. Extensive training and education be given to all Health Sciences students and future healthcare workers about the ill effects of excessive sugar consumption and trained in rendering dietary counselling and advice to prospective patients. It should not be the sole domain of dietitians and nutritionists, and other closely related workers such as oral hygienists, dental therapists, and dentists advise patients of the effects of excessive sugar consumption.

2. There should be significant education and behaviour changing campaigns and programs aimed at educating both health care providers and patients in the caregivers and adults and children in general, about appropriate choices of beverages an encouraging water consumption. These programs should be implemented at both pre-school and school levels to encourage a healthy foundational base. It is further suggested that at all schools and other educational facilities such as creches and universities and all private and public buildings and facilities, there should be unlimited access to drinking water. For example, this could be through the availability of water fountains and other drinking points, being strategically placed. Building on this, SSBs and other sweet beverages should not be made available in these facilities.

3. Many parents use SSBs and other forms of sugary treats to both bribe their children into receiving healthcare, or as a reward for undergoing or receiving such healthcare. Healthcare workers should undertake every effort to stop or reduce this practice amongst the parents of their patients.

4. Every cadre of healthcare worker should be encouraged to educate parents to avoid making SSBs and other sweet treats available at home.

3.6 Conclusion

It is evident from the research results that several considerations need to be affected to improve adherence to help promotion efforts that could decrease sugar consumption, especially the consumption of SSBs. More attention should be given to the prioritisation of the health education and training of future and existing health care practitioners to ensure that they are satisfactorily positioned to provide health care advice to the patients and the public. This could lead to increased knowledge and understanding of the adverse effects of high sugar consumption levels, especially as hidden sugars in SSBs. It is envisaged that such training and education, as well as increased health promotion efforts by all stakeholders, including local and national health departments and other health care advocacy groups, would lead to a decline in the per capita sugar consumption rates end subsequently declines in obesity and other lifestyle conditions such as diabetes. Further research in the role of other professionals, and the curricular in terms of diet and nutrition, should be undertaken to provide researchers and educationists with solid data that will enable them to make recommendations related to the curricular and training of nutrition care amongst all health professionals.

REFERENCES

Adams, K.M., Kohlmeier, M., Zeisel, S.. (2010), "Nutrition education in U.S. medical schools: latest update of a national survey," *Academic Medicine*, 85, **9**, 1537–1542. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4042309/. [Accessed 21 March 2020].

Allen, W.M.K., Allen, K.J. (2020). Should Australia tax sugar-sweetened beverages. *Journal of Paediatrics and Child Health*: **56**; 8-15. Available at: https://onlinelibrary.wiley.com/doi/full/10.1111/jpc.14666. [Accessed 21 March 2020].

Anderson, A., Dewar, J., Marshall, D., Cummins, S., Taylor, M., Dawson, J., and Sparkset, L. (2007). The development of a healthy eating indicator shopping basket tool (HEISB) for use in food access studies – identification of key food items. *Public Health Nutrition* **10**, 1440–1447. Available at: https://www.researchgate.net/publication/233710448_Accessing_healthy_food_Availability_and_price_of_a_healthy_food_basket_in_Scotland. [Accessed 07August 2020].

Australian Beverages Council (2017). Why a soft drink tax is not the answer. Available at: http://www.australianbeverages.org/for-consumers/soft-drink-tax-answer/.[Accessed 07August 2020].

Australian Institute of Health and Welfare. (2016). Australia's Health, 2016. Catalogue no. AUS 199. Canberra: AIHW. e7492. Available at: https://www.aihw.gov.au/reports/australias-health/australias-health-2016/contents/summary. [Accessed 21 March 2020].

Australian Bureau of Statistics. (2014). Australian Health Survey: Nutrition First Results – Foods and Nutrients, 2011-12. Canberra, ACT: The Bureau. Available at: https://www.abs.gov.au/statistics/health/health-conditions-and-risks/australian-health-survey-nutrition-first-results-foods-and-nutrients/latest-release. [Accessed 21 March 2020].

Backholer, K., Blake, M., Vandevijvere, S. (2016). Have we reached a tripping point for sugar-sweetened beverage taxes? *Public Health Nutrition*: **19**: 3057-61. Available at: https://www.cambridge.org/core/journals/public-health-nutrition/article/have-we-reached-a-tipping-point-for-sugarsweetened-beverage-taxes/9913F2D4692ECD2A155039FB1EA54C49. [Accessed 21 March 2020].

Backholer, K., Martin, J. (2017). Sugar-sweetened beverage tax: the inconvenient truth. *Public Health Nutrition*: 20(18), 3225–3227. Available at: https://www.cambridge.org/core/journals/public-health-nutrition/article/sugar-sweetened-beverage-tax-the-inconvenient-truths/C48613EFA36606E6EF36597FE422306A. [Accessed 07August 2020].

Backholer, K., Vandevijvere, S., Blake, M., Tseng, M. (2019). Sugar-sweetened beverage taxes in 2018: a year of reflections and consolidation. *Public Health Nutrition*: 21(18), 3291–329. Available at: https://pubmed.ncbi.nlm.nih.gov/30449291/. [Accessed 07August 2020].

Bernabé, E., Vehkalahti, M.M., Sheiham, A., Aromaa, A., Suominen, A.L. (2014). Sugar-sweetened beverages and dental caries in adults: A 4-year prospective study. Journal of Dentistry, 42(8), 952-958. Available at:https://researchportal.helsinki.fi/en/publications/sugar-sweetened-beverages-and-dental-caries-in-adults-a-4-year-pr. [Accessed 07August 2020].

Bleich, S.N., Barry, C.L., Gary-Webb, T.L., Herring, B.J. (2014). Reducing sugar-sweetened beverage consumption by providing caloric information: how black adolescents alter their purchases and whether the effects persist. *American Journal of Public Health*, 104(1**2**), 2417-2424. Available at: https://pubmed.ncbi.nlm.nih.gov/25322298/. [Accessed 07August 2020].

Bomback, A.S., Derebail, V.K., Shoham, D.A., Anderson, C.A., Steffen, L.M., Rosamond, W.D., and Kshirsagar, A.V. (2010). Sugar-sweetened soda consumption, hyperuricemia, and kidney. *Kidney International*, 77(**7**). 609-616. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3299001/. [Accessed 21 March 2020].

Centre for Science in the Public Interest. (2016). Big Soda vs. Public Health (2016 Edition). https://cspinet.org/resource/ big-soda-vs-public-health-1. Available at: https://cspinet.org/resource/big-soda-vs-public-health-1. [Accessed 21 March 2020].

Creedy, J. (2019). A note on sugar taxes and changes in total calorie consumption, *New Zealand Economic Papers*, 53:**3**, 307-314. Available at: https://www.tandfonline.com/doi/abs/10.1080/00779954.2018.1516232. [Accessed 07August 2020].

Crowley, J., Ball, L., Han, D, Y., Arroll, B., Leveritt, M., Wall, C. (2015). New Zealand Medical Students Have Positive Attitudes and Moderate Confidence in Providing Nutrition Care: A Cross-Sectional Survey. *Journal of Biomedical Education*. 1- 7. Available at: https://www.hindawi.com/journals/jbe/2015/259653/. [Accessed 21 March 2020].

Finkelstein, E.A., Graham, W.C.K., Malhotra, R. (2014). Lifetime direct medical costs of childhood obesity. *Paediatrics*, 133(5), 854-862. Available at: https://pubmed.ncbi.nlm.nih.gov/24709935/. [Accessed 21 March 2020].

Fung, T.T., Malik, V., Rexrode, K.M., Manson, J.E., Willet, W.C. and Hu, F.B. (2009). Sweetened beverage consumption and risk of coronary heart disease in women. *Am J Clin Nutr* 89, 1037–1042. Available at: https://pubmed.ncbi.nlm.nih.gov/19211821/. [Accessed 21 March 2020].

Glanz, K. (1997). “Review of nutritional attitudes and counselling practices of primary care physicians,” *American Journal of Clinical Nutrition*, **65**, 6, 2016S–2019S. Available at:https://academic.oup.com/ajcn/article/65/6/2016S/4655682. [Accessed 07August 2020].

Gortmaker, S.L., Swinburn, B.A., Levy, D., Carter, R., Mabry, P.L., Finegood, D.T., Huang, T., Marsh, T., Moodie, M.L. (2011). Changing the future of obesity: science, policy, and action. *Lancet Lond. Engl.* **378**, 838–847. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3417037/. [Accessed 21 March 2020].

Grimes, C.A., Riddell, L.J., Campbell, K.J., Nowson, C.A. (2013). Dietary salt intake, sugar-sweetened beverage consumption, and obesity risk. *Paediatrics*, 131(1), 14-21. Available at: https://pediatrics.aappublications.org/content/131/1/14. [Accessed 07August 2020].

Guh, D.P., Zhang, W., Bansback, N., Amarsi, Z., Birmingham, C.L., Anis, A.H. (2009). The incidence of co-morbidities related to obesity and overweight: A systematic review and meta-analysis. *BioMed Central Public Health*, 9(1), 88. Available at: https://pubmed.ncbi.nlm.nih.gov/19320986/. [Accessed 21 March 2020].

HEALA (Healthy Living Alliance) (2017) Obesity and NCDs. Available at: https://heala.org/donations/obesity-and-ncd/. [Accessed 07August 2020].

Hu, F.B. (2013). Resolved: there is sufficient scientific evidence that decreasing sugar-sweetened beverage consumption will reduce the prevalence of obesity and obesity-related diseases: Sugar-sweetened beverages and risk of obesity. *Obes. Rev*. **14**, 606–619. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5325726/#:~:text=The%20meta%2Danalysis%20found%20that,1.19%3B%20P%3D0.001). [Accessed 21 March 2020].

Jayalath, V.H., de Souza, R.J., Ha, V., Mirrahimi, A., Blanco-Mejia, S., Di Buono, M., Kendall, C.W. (2015). Sugar-sweetened beverage consumption and incident hypertension: A systematic review and meta-analysis of prospective cohorts. *The American Journal of Clinical Nutrition*, 102(**4**), 914-921. Available at: https://pubmed.ncbi.nlm.nih.gov/26269365/. [Accessed 07August 2020].

Katz, D.L. (2018). How to Improve Clinical Practice and Medical Education About Nutrition. *AMA Journal of Ethics*: 20,**10**: E994-1000. Available at: https://www.researchgate.net/publication/328462598_How_to_Improve_Clinical_Practice_and_Medical_Education_About_Nutrition. [Accessed 21 March 2020].

Khan, S.Y., Holt, K., Tinanoff, N. (2017). Nutrition Education for Oral Health Professionals: A Must, Yet Still Neglected. *J Dent Educ*: 81, 3-4. Available at: https://pubmed.ncbi.nlm.nih.gov/28049671/. [Accessed 21 March 2020].

Le Bodoa, Y., Etiléc, F., Gagnond, F., De Wals, P. (2019). Conditions influencing the adoption of a soda tax for public health: Analysis of the French case (2005–2012). *Food Policy*: **88**; 101765. Available at: https://ideas.repec.org/a/eee/jfpoli/v88y2019ics0306919219305871.html. [Accessed 21 March 2020].

Malik, V.S., Hu, F.B. (2019). Sugar-sweetened beverages and cardiometabolic Health: An update of the evidence. Nutrients, 11(8), 1840. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6723421/. [Accessed 21 March 2020].

Malik, V.S., Popkin, B.M., Bray, G.A., Despres, J.P. Hu. F.U. (2010a). Sugar-sweetened beverages, obesity, type 2 diabetes mellitus, and cardiovascular disease risk. *Circulation*, 2010; **121**:1356-64. Available at: https://www.ahajournals.org/doi/full/10.1161/CIRCULATIONAHA.109.876185. [Accessed 07August 2020].

Malik, V.S., Popkin, B.M., Bray, G.A et al. (2010b) Sugar-sweetened beverages and risk of metabolic syndrome and type 2 diabetes: a meta-analysis. *Diabetes Care,* 33, 2477–2483. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2963518/. [Accessed 21 March 2020].

Manyema, M., Veerman, L.J., Chola, l., Tugendhaft, A., Sartorius, B., Labadarious, D. and Hofman, K.J. 2014. The Potential Impact of a 20% Tax on Sugar-Sweetened Beverages on Obesity in South African Adults: A Mathematical Model. *PLOS ONE*, 9(8), 1-10. Available at: https://pubmed.ncbi.nlm.nih.gov/25136987/. [Accessed 07August 2020].

McKay, B., Sauer, S., Richardson, B, Herre, R. (2016). The political economy of sugarcane flexing: initial insights from Brazil, Southern Africa and Cambodia. *The Jnrl of Peasant Stud***,** 43(1); 195-223. Available at: https://www.tandfonline.com/doi/abs/10.1080/03066150.2014.992016. [Accessed 21 March 2020].

Megally, R., Al-Jawaldeh, A. (2020). Impact of sin taxes on consumption volumes of sweetened beverages and soft drinks in Saudi Arabia. *F1000 Research*, **9**:1117. Available at: https://f1000research.com/articles/9-1117. [Accessed 21 March 2020].

Ministry of Health. (2014). "Visiting a doctor," Available at: http://www.health. govt.nz/your-health/services-and-support/health-care-services /visiting-doctor. [Accessed 21 March 2020].

Myers, A., Fig, D., Tugendhaft, A., Mandle, Myers, J., Hofman, K. (2017). Sugar and health in South Africa: Potential challenges to leveraging policy change. *Global Health Policy.* 12(1), 98-115. Available at: https://pubmed.ncbi.nlm.nih.gov/26315455/. [Accessed 21 March 2020].

National Department of Health. (2013). Strategic Plan for the Prevention and Control of Non-Communicable Diseases 2013-17. Pretoria, South Africa: NDOH. Available at: https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/55630/IDL-55630.pdf?sequence=1. [Accessed 05 May 2020].

Palmer, C.A. (1990). Applied nutrition in dental education: issues and challenges. *J Dent Educ*: 54(**8**):513–8. Available at: https://pubmed.ncbi.nlm.nih.gov/2199544/. [Accessed 21 March 2020].

Pan, A. and Hu, F.B. (2011). Effects of carbohydrates on satiety: Differences between liquid and solid food. *Curr Opin Clin Nutr Metab Care* **14,** 385-390. Available at: https://pubmed.ncbi.nlm.nih.gov/21519237/. [Accessed 21 March 2020].

Popkin, B.M. (2017). Changes in prices, sales, consumer spending, and beverage consumption one year after a tax on sugar-sweetened beverages in Berkeley, California, US: A before-and-after study. *PLoS Med*. 1**4**, e1002283. Available at: https://pubmed.ncbi.nlm.nih.gov/28419108/. [Accessed 21 March 2020].

Public Health, England. (2018). Sugar reduction and broader reformulation programme: Report progress towards the first 5% reduction and next steps. Available at: https://assets.publishing. service.gov.uk/government/uploads/system/uploads/attachment_data/file/709008/Sugar_reduction_progress_report.Pdf. [Accessed 21 March 2020].

Redondo, M., Hernández-Aguado, I., Lumbreras, B. (2018). The impact of the tax on sweetened beverages: a systematic review. *Am. J. Clin. Nutr*. **108**, 548–563. Available at: https://pubmed.ncbi.nlm.nih.gov/30535085/. [Accessed 21 March 2020].

Roberts, K.E., Ells, L.J., McGowan, V.J., Machaira, T., Targett, V.C., Allen, R.E., Tedstone, A.E. (2017). A rapid review examining purchasing changes resulting from fiscal measures targeted at high sugar foods and sugar-sweetened drinks. *Nutr. Diabetes*. **7.** Available at: https://www.nature.com/articles/s41387-017-0001-1. [Accessed 05 May 2020].

Rosinger, A., Herrick, K., Gahche, J., Park, S. (2017). Sugar-sweetened beverage consumption among U.S. adult, 2011–2014 (NCHS Data Brief No. 270). Available at: https://pubmed.ncbi.nlm.nih.gov/28135185/. [Accessed 21 March 2020].

Silver, L.D., Ng, S.W., Ryan-Ibarra, S., Taillie, L.S., Induni, M., Miles, D.R., Poti, J.M. Popkin, B.M. (2017). Changes in prices, sales, consumer spending, and beverage consumption one year after a tax on sugar-sweetened beverages in Berkeley, California, US: A before-and-after study. *PLoS Med*. 1**4**, e1002283. Available at: https://www.researchgate.net/publication/316716716_Changes_in_prices_sales_consumer_spending_and_beverage_consumption_one_year_after_a_tax_on_sugar-sweetened_beverages_in_Berkeley_California_US_A_before-and-after_study. [Accessed 05 May 2020].

South African Sugar Association [SASA] Official website. (2013-2014). Available at Available at: http://www.sasa.org.za/. [Accessed 21 March 2020].

South African Sugar Association [SASA] Official website. (2019). Available at Available at: http://www.sasa.org.za/. [Accessed 21 March 2020].

Strom, S. (2018). '*Fat tax' in Denmark is repealed after criticism*. The New York Times. Available at: https://www.nytimes.com/2012/11/13/business/global/fat-tax-in-denmark-is-repealed-after-criticism.html#:~:text=Citing%20a%20harmful%20effect%20on,fats%2C%20after%20just%20one%20year. [Accessed 21 March 2020].

Taveras, E.M., Gillman, M.W., Kleinman, K., Rich-Edwards, J.W., Rifas-Shiman, S.L. (2010). Racial/ethnic differences in early-life risk factors for childhood obesity. *Pediatrics*, 125(4), 686-695. Available at: https://europepmc.org/article/med/20194284. [Accessed 05 May 2020].

Te Morenga, L., Mallard, S., Mann, J. (2012). Dietary sugars and body weight: systematic review and meta-analyses of randomised controlled trials and cohort studies. *BMJ* 346, e7492. Available at: https://www.bmj.com/content/346/bmj.e7492. [Accessed 21 March 2020].

Thow, A.M., Downs, S.M., Mayes, C., Trevena, H., Waqanivalu, T., Cawley, J. (2018). Fiscal policy to improve diets and prevent non-communicable diseases: from recommendations to action. *Bull. World Health Organ*. **96**, 201–210. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5840623/. [Accessed 21 March 2020].

United Nations. (2011). Political Declaration of the High-level Meeting of the General Assembly on the Prevention and Control of Non-communicable Diseases. A/66/L.1. Available at: https://digitallibrary.un.org/record/710899/?ln=en. [Accessed 21 March 2020].

Ventura, A.K., Menella, J.A. (2011). Innate and learned preferences for sweet taste during childhood. *Curr Opin Clin Nutr Metab Care* **14,** 379-384. Available at: https://pubmed.ncbi.nlm.nih.gov/21508837/. [Accessed 05 May 2020].

Walker, W.A. (2000). "Advances in nutritional education for medical students," *The American Journal of Clinical Nutrition*, **72**, 865S–867S. Available at: https://www.hindawi.com/journals/jbe/2015/259653/. [Accessed 21 March 2020].

Wang, Y.C., Coxson, P., Shen, Y.M., Goldman, L., Bibbins-Domingo, K. (2012). A penny-per-ounce tax on sugar-sweetened beverages would cut health and cost burdens of diabetes. *Health Affairs.* 31(1):199-207. Available at: https://pubmed.ncbi.nlm.nih.gov/22232111/. [Accessed 05 May 2020].

Weinsier, R.L., Boker, K., Feldman, E.B., Read, M.S., Brooks, M. (1986). "Nutrition knowledge of senior medical students: a collaborative study of southeastern medical schools," *American Journal of Clinical Nutrition*, **43** .6, 959–968. Available at: https://www.researchgate.net/publication/19445007_Nutrition_knowledge_of_senior_medical_students_A_collaborative_study_of_southeastern_medical_schools. [Accessed 21 March 2020].

Wright, A., Smith, K.E., Howell, M. (2017). Policy lessons from health taxes: a systematic review of empirical studies. *BMC Public Health:* **17**. Available at: https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-017-4497-z. [Accessed 05 May 2020].

World Health Organisation (WHO). (2019). *Taxes on Sugary Drinks: Why do it?* Geneva, Switzerland: The Organisation. Available at: https://apps.who.int/iris/bitstream/handle/10665/260253/WHO-NMH-PND-16.5Rev.1-eng.pdf;jsessionid=8BDBA76BB467A3D6D917A38121CFB9E5?sequence=1. [Accessed 21 March 2020].

World Health Organisation (WHO). (2017). *Fiscal Policies for Diet and Prevention of Noncommunicable Diseases.* Geneva, Switzerland: The Organisation. Available at: https://www.who.int/dietphysicalactivity/publications/fiscal-policies-diet-prevention/en/. [Accessed 21 March 2020].

World Health Organisation (WHO). (2015). *Using Price Policies to Promote Healthier Diets.* Geneva, Switzerland: The Organisation. Available at: https://www.euro.who.int/__data/assets/pdf_file/0008/273662/Using-price-policies-to-promote-healthier-diets.pdf. [Accessed 21 March 2020].

World Health Organisation (WHO). (2015). Guideline: sugars intake for adults and children. Geneva, Switzerland. Available at: https://www.who.int/publications/i/item/9789241549028. [Accessed 21 March 2020].

World Health Organisation (WHO). (2014). Global status report on noncommunicable diseases 2014: attaining the nine global noncommunicable diseases targets; a shared responsibility. World Health Organisation, Geneva, Switzerland. Available at: https://apps.who.int/iris/bitstream/handle/10665/148114/9789241564854_eng.pdf?sequence=1. [Accessed 21 March 2020].

World Health Organisation (WHO).(2004). Global strategy on diet, physical activity and health. World Health Organisation (WHO). Available at: https://www.who.int/nmh/wha/59/dpas/en/. [Accessed 21 March 2020].

Yang, l., Bovet, P., Liu, Y. (2017). Consumption of carbonated soft drinks among adolescents aged 12 to 15 years in 53 low- and middle-income countries. *Am. J. Public Health*: **107**; 1095-100. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5463205/. [Accessed 21 March 2020].

Appendix 1 – Gatekeeper Permission

Directorate for Research and Postgraduate Support
Durban University of Technology
Tromso Annexe, Steve Biko Campus
P.O. Box 1334, Durban 4000
Tel.: 031-3732576/7
Fax: 031-3732948

09th September 2020
Dr Lavern Samuels
c/o School of Health Sciences
University of KwaZulu-Natal

Dear Dr Samuels

PERMISSION TO CONDUCT RESEARCH AT THE DUT

Your email correspondence in respect of the above refers. I am pleased to inform you that, the Institutional Research and Innovation Committee (IRIC) has granted Full Permission for you to conduct your research "Knowledge, Attitudes and Practices of Exit-Level Health Sciences Students at a Selected University in Durban, South Africa, towards the Consumption of Sugar-containing Beverages Following the Introduction of the Sugar Tax in South Africa" at the Durban University of Technology.

The DUT may impose any other condition it deems appropriate in the circumstances having regard to nature and extent of access to and use of information requested.

We would be grateful if a summary of your key research findings can be submitted to the IRIC on completion of your studies.

Kindest regards.
Yours sincerely

DR LINDA ZIKHONA LINGANISO
DIRECTOR: RESEARCH AND POSTGRADUATE SUPPORT DIRECTORATE

Appendix – Research Ethics Approval Certificate

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

15 September 2020

Dr Lavern Samuels (8421312)
School of Health Sciences
Westville

Dear Dr Samuels,

Protocol reference number: BREC/00001337/2020
Project title : Knowledge, Attitudes and Practices of Exit-Level Health Sciences Students at a Selected University in Durban, South Africa, towards the Consumption of Sugar-containing Beverages Following the Introduction of the Sugar Tax in South Africa
Degree Purposes: MMedSci

EXPEDITED APPLICATION: APPROVAL LETTER

A sub-committee of the Biomedical Research Ethics Committee has considered and noted your application.

The conditions have been met and the study is given full ethics approval and may begin as from 15 September 2020. Please ensure that outstanding site permissions are obtained and forwarded to BREC for approval before commencing research at a site.

This approval is subject to national and UKZN lockdown regulations dated 26th August 2020, see (http://research.ukzn.ac.za/Libraries/BREC/BREC_Lockdown_Level_2_Guidelines.sflb.ashx). Based on feedback from some sites, we urge PIs to show sensitivity and exercise appropriate consideration at sites where personnel and service users appear stressed or overloaded.

This approval is valid for one year from 15 September 2020. To ensure uninterrupted approval of this study beyond the approval expiry date, an application for recertification must be submitted to BREC on the appropriate BREC form 2-3 months before the expiry date.

Any amendments to this study, unless urgently required to ensure safety of participants, must be approved by BREC prior to implementation.

Your acceptance of this approval denotes your compliance with South African National Research Ethics Guidelines (2015), South African National Good Clinical Practice Guidelines (2006) (if applicable) and with UKZN BREC ethics requirements as contained in the UKZN BREC Terms of Reference and Standard Operating Procedures, all available at http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx.

BREC is registered with the South African National Health Research Ethics Council (REC-290408-009). BREC has US Office for Human Research Protections (OHRP) Federal-wide Assurance (FWA 678).

The sub-committee's decision will be noted by a full Committee at its next meeting taking place on 13 October 2020.

Yours sincerely,

Prof D Wassenaar
Chair: Biomedical Research Ethics Committee

Biomedical Research Ethics Committee
Chair: Professor D R Wassenaar
UKZN Research Ethics Office Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban 4000
Email: BREC@ukzn.ac.za
Website: http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx

Appendix 3- Information Sheet and Consent to Participate in Research

Information Sheet and Consent to Participate in Research

Date:

Dear Student

Study Title: Knowledge, Attitudes and Practices of Exit-Level Health Sciences Students at a Selected University in Durban, South Africa, towards the Consumption of Sugar-containing Beverages Following the Introduction of the Sugar Tax in South Africa

My name is Dr Lavern Samuels. I am a student from the Discipline of Dentistry, College of Health Science, University of Kwa-Zulu Natal. My contact details are: samuelsl@dut.ac.za (e-mail) and telephone 083 780 8993.

You are being invited to consider participating in a study that involves research on the knowledge, attitudes and practices of exit-level health sciences students at the Durban University of Technology, towards the consumption of sugar-containing beverages following the introduction of the sugar tax in South Africa a few years ago. The aim of the study is to understand the effects of this tax on young healthcare professionals who will soon be entering into the healthcare sector as healthcare providers.

The study is expected to enrol 305 exit-level health students from the Durban University of Technology campus located in Durban. You will be given a questionnaire and asked to answer a few questions. This will take about 10-15 minutes. The duration of your participation if you choose to enrol and remain in the study is expected to be limited to the completion of the questionnaire. The study is funded by myself as the student and I have no conflict of interest to declare. It is not expected that the study will cost you anything, and no reimbursement will be made for participating in this study.

You are assured of privacy and confidentiality, as I will not be recording any personal contact details. research is voluntary and you may withdraw your participation at any point without penalty. There is no reimbursement for participation in the study.

This study has been ethically reviewed and approved by the UKZN Biomedical Research Ethics Committee (approval number_____).

The study does not involve any known risks and/or discomforts. The study will provide no immediate direct benefits to participant. It is hoped that the knowledge gained from this study could be used to construct further education and training programmes that would lead to improved health practitioner knowledge and dietary advice practices.

This study has been ethically reviewed and approved by the UKZN Biomedical research Ethics Committee (approval number_____).

In the event of any problems or concerns/questions you may contact the researcher at (provide contact details) or the UKZN Biomedical Research Ethics Committee, contact details as follows:

BIOMEDICAL RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus
Govan Mbeki Building
Private Bag X 54001
Durban
4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604769 - Fax: 27 31 2604609

Email: BREC@ukzn.ac.za

In order to protect the confidentiality of personal information you will not be asked you name, and instead be provided with a numbered questionnaire. All information will be stored in a locked cupboard at UKZN, and any electronic information will be stored in a password-protected computer. Five years after the study has been complete d the date will be destroyed by shredding in the case of hard copies, and by data erasing and deletion in the case of electronic data.

CONSENT

I, _____

(Name) have been informed about the study entitled “Knowledge, Attitudes and Practices of Exit-Level Health Sciences Students at a Selected University in Durban, South Africa, towards the Consumption of Sugar-containing Beverages Following the Introduction of the Sugar Tax in South Africa by Dr L Samuels

I understand the purpose and procedures of the study.

I have been given an opportunity to answer questions about the study and have had answers to my satisfaction.

I declare that my participation in this study is entirely voluntary and that I may withdraw at any time without affecting any treatment or care that I would usually be entitled to.

If I have any further questions/concerns or queries related to the study I understand that I may contact the researcher telephonically at 083 780 8993 or via e-mail at samuelsl@dut.ac.za

If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researchers then I may contact:

BIOMEDICAL RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus
Govan Mbeki Building
Private Bag X 54001
Durban
4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604769 - Fax: 27 31 2604609

Email: BREC@ukzn.ac.za

_____	_____
Signature of Participant	**Date**
_____	_____
Signature of Witness (Where applicable)	**Date**
_____	_____
Signature of Translator (Where applicable)	**Date**

Appendix 4

Questionnaire

Participant Code_____{create your own code (not your name)}

Section A: Demographics

1. Age:_____
2. Gender: M____ F____ Other_____
3. Race: African ___ Coloured____ Indian_____ White_____
4. Profession: (Please place a X next to your profession.)

   Chiropractic____

   Child and Youth Care____

   Homeopathy___

   Emergency Care____

   Medical Orthotics and Prosthetics___

   Nursing_____

   Radiography___

   Somatology___

5. Marital status

Single___ Married___ Other___

6. Household/Residence:

- Where do you live whilst studying?
- University residence _____
- Other residence_____
- At home_____

7. Where did you reside prior to studying, and with whom?

- At home, alone____

- At home, with parents/family/others____ If you answered YES to this question please list how many people lived in the same home, and their status, for example father (employed), three sisters (one adult – studying, one teenager – studying, one child aged 4 – attends crèche) etc.

Person_____ Status _____ Age_____

Person_____ Status _____ Age_____

Person_____ Status _____ Age_____

Person_____ Status _____ Age_____

Person_____ Status _____ Age_____

8. Where did you reside prior to studying?

Urban area_____ Rural area_____

9. What is your monthly family total income?

____ R0 – R1500

____R2501 - R3000

____R3001 – R5000

____R5001 – R9999

____R10 000 – R25000

____+R25000

10. Who is responsible for food and beverage purchases at your current residence?

___ self

___parent/other

----- catered meals and drinks

Section B: Knowledge

11. Are you aware that South Africa has a “sugar tax”?

Yes___ No___ Uncertain____

12. Are you aware of the purpose of the introduction of the sugar tax?

Yes___ No___ Uncertain____

13. Please list as many different types of beverages/drinks that you are aware of that CONTAIN SUGAR?

_____

_____

_____

_____

_____

Section C: Attitudes

16. Have you changed to drinking low-sugar or sugar-free beverages since the introduction of the sugar tax, and why? (Select Yes or No)

Yes___Reason_____

_____

_____

_____

No___Reason_____

_____

_____

_____

17. As a qualified healthcare provider would you encourage your patients to move away from drinking sugar-sweetened beverages?

Yes ___ No___

18. Do you think that there is merit (good) in the implementation of a sugar tax? Give a reason for your answer

Yes___ or No ____

Reason_____

_____

_____

_____

Section D: Perceptions

19. There has been resistance from the sugar and beverage industry to the sugar tax. Do you support this resistance, and why?

Support_____ Do Not Support _____

Reason:_____

_____

_____

_____

20. Are you confident that you have received sufficient education and training around diet and nutrition to advise your future patients with regards to the consumption of sugar-sweetened beverages? Please substantiate your answer.

Yes___ No___

21. Any comments/suggestions?

_____

_____

_____

_____

_____

This is the end – thank you.

Appendix 5 – Research Ethics Certificates

Zertifikat Certificado
Certificat Certificate

TRREE

Promouvoir les plus hauts standards éthiques dans la protection des participants à la recherche biomédicale
Promoting the highest ethical standards in the protection of biomedical research participants

Clinical Trials Centre
The University of Hong Kong

Certificat de formation - Training Certificate

Ce document atteste que - this document certifies that

Lavern Samuels

a complété avec succès - has successfully completed

South Africa

du programme de formation TRREE en évaluation éthique de la recherche
of the TRREE training programme in research ethics evaluation

Release Date: 2020/04/13

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator

FMH

FPH

Ce programme est soutenu par - This program is supported by :